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American Journal
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VOL. 34 MARCH, 1948 NO. 3

Original Articles

THE EVOLUTION OF SOME ORTHODONTIC SYSTEMS IN NATURE*

WILLIAM KING GREGORY, PH.D., SC.D.,** NEW YORK, N. Y.

PRELIMINARY FACTS AND PRINCIPLES

ALL the problems of dentists and orthodontists obviously stem in part from the fact that man is a jaw-bearing animal. Only the plants can utilize the sun's rays directly in building their power sources, but man, like other animals, must appropriate his, either from other animals or from the plants. Even now his jaws and teeth testify clearly to his animal ancestry. Due to thousands of special investigations, mostly since Darwin's time, the chief stages of ascent through the ages from primeval life to man are becoming increasingly clear at least in their main outlines. Let us then draw from the crowded storehouses of paleontology and comparative anatomy the materials for the following sketch of the evolution of some orthodontic systems in nature.

The great problem for all types of animals obviously is to get near the food and to pull it into the gut. Jaws and teeth if present come into action only after the nervous and locomotor systems have made contact with the food.

Jaws and teeth are a relatively advanced development, found only in highly organized many-celled animals. They are conspicuously absent in the vast hosts of one-celled animals, sponges, jellyfishes, corals, etc., and only begin to be developed at the level of the marine annelid worms.

Among such one-celled animals as *Paramecium* (the slipper animalcule), the lashing of cilia first propels the animal to the food and then pulls into the gut water containing minute food particles. *Amoeba*, which is probably a secondarily simplified form adapted for terrestrial progression, merely flows around the food particle and engulfs it.

Curiously jawlike organs called avicularia of microscopic size are found on the side of the sack-like body-wall of certain bryozoa or marine moss animals.

Read before the Orthodontic Division of the Department of Dentistry, Columbia University, Nov. 11, 1947.

*Dedicated to the memory of Milo Hellman, D.D.S., SC.D., Late Professor of Dentistry, Columbia University, New York.

**Da Costa Professor Emeritus of Vertebrate Palaeontology, Columbia University; Curator Emeritus of the Departments of Comparative Anatomy and Fishes, American Musuem of Natural History.

These minute objects look like a bird's head, and each is provided with sharply snapping toothless jaws moved by relatively large muscles. The jaw seems to have been derived from a modified operculum or horny lid and the muscles from the retractor muscles of the operculum. The resemblance of an avicularium to a bird's head affords a good example of fortuitous, convergent resemblances between very widely separated groups.

Perhaps the most peculiar of all known orthodontic systems is that which is shown in the apparatus called "Aristotle's lantern," found in the interior of sea urchins and sand cakes. In these five-rayed relatives of the starfish, the partly protrusile mouth, which is on the underside of the animal, is surrounded by five pointed teeth; each of these is independently movable, being set in its own framework and moved by numerous muscles. All five teeth converge toward a point; collectively, the apparatus is used for snipping off bits of seaweed or dead fish upon which the animal feeds. This mechanism shares the five-rayed plan of the animal itself, and the numerous separate pieces of which it is composed seem to have been secreted in the walls of the partly protrusile pharynx.

Problems in orthodontics are, indeed, not limited to man or even to the vertebrates. Among the three-layered or metazoan invertebrates there are many systems for seizing and/or subdividing the food. In marine annelid worms, for example, there is a muscular pharynx or pouch, containing horny jaws, which can be protruded and brought into contact with the food. Among the molluscs, in sea snails a much more complicated protrusile pouch contains a radula or flexible band saw, set with thousands of minute teeth. With this, the drill and many other robber-snails rasp neat round holes in the shells of clams and oysters, and through these holes the robber can suck up the fluids and finely subdivide the flesh of its victim.

In the trilobites, or most ancient known forms of the arthropods or externally jointed animals, the body was propelled by paired jointed appendages each bearing a flap or gill and a jointed limb. In the huge jawlike fighting claws of the lobsters and crabs, the distal segment of the limb serves as a fulcrum and its antagonist serves as a lower jaw. The movement of the latter is limited by a hingelike joint. The power comes from strong muscles in the interior of the shell. These jawlike fighting claws of the lobster are provided with toothlike projections which increase the pinching and biting power. Here, then, are certain prerequisite conditions for an orthodontic system: namely, a fixed fulcrum, a movable lever arm, the adductor power of well-based muscles, and, last but not least, the presence of stiff unyielding skeletal parts which limit the movement to certain paths. These principles are also illustrated in the true jaws of typical arthropods, which were likewise evolved from paired jointed appendages originally serving for locomotion and respiration.

BEGINNINGS OF VERTEBRATE JAWS

The jaws of vertebrates were, it seems, not derived from locomotor appendages, but were by-products of the external and internal skeletal tissue of the mouth and pharynx or gill chamber.

In *Amphioxus*, the lancelet, which is a specialized side branch from near the base of the vertebrate tree, there is a huge pharynx or gill chamber, which serves

also as a sieve for the incoming water, and at the bottom of the chamber there is a ciliated groove leading backward to the gut. *Amphioxus* thus serves as an example of a jawless but actively swimming food-sifter. The baglike typical ascidians, although arising from free-swimming larvae, settle down into sessile food-sifters.

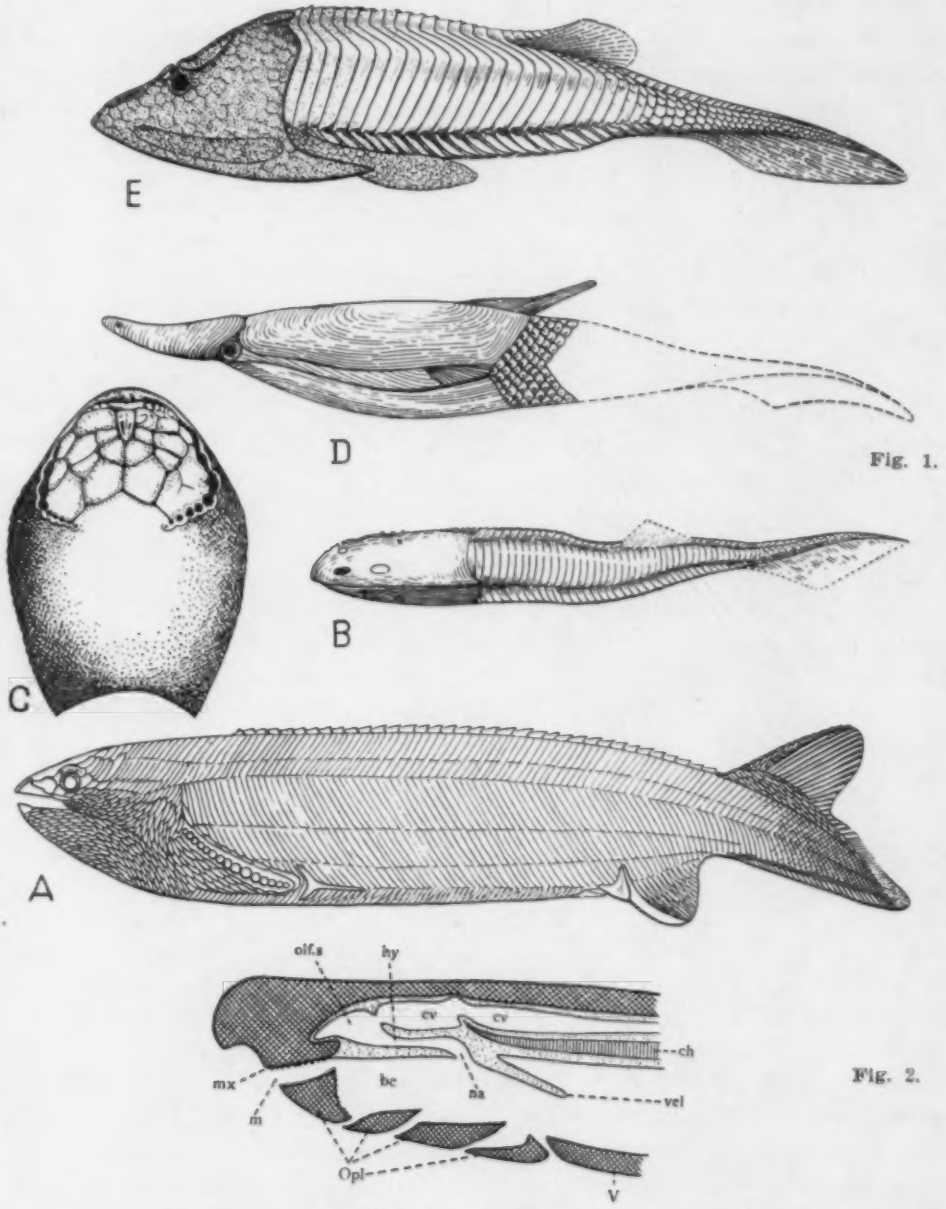


Fig. 1.

Fig. 2.

Fig. 1.—Restorations of ostracoderms. From Gregory. *A*, *Rhyncholepis*, after Kiaer; *B*, *Trematapsis*, after Rohon; *C*, *Trematapsis*, ventral view of throat and breast-buckler, after Patten; *D*, *Pteraspis*, after Powrie and Lankester; *E*, *Cephalaspis*, composite, mainly after Patten.

Fig. 2.—*Pteraspis*. Diagram of longitudinal section through head shield with attempted restoration of soft parts surrounding the olfactory sac *(olf. s)*, the brain cavity *(cv)*, the hypophysial sac *(hy)*, and its narial opening *(na)* into the buccal cavity *(bc)*. *Opl*, suboral plates; *V*, ventral shield; *vel*, velum; *ch*, notochord. (After Kiaer.)

The oldest known fossil vertebrates were the ostracoderms (Fig. 1) of the Ordovician and Silurian ages. These were fishlike in form, and as in *Amphioxus* the body was driven forward by undulations caused by rhythmic contraction of muscle segments on either side of the body. In the more typical ostracoderms, the head and chest were covered with armor made of hard plates of bone or bonelike substance. Behind the mouth, on the throat, in *Trematapis* (Fig. 1, *C*) and others were small throat plates, which would permit a pumping or sucking action through the mouth and gills. In *Pteraspis* (Figs 1, *D* and 2), there were small plates on the roof of the mouth, some of them bearing thornlike denticles. Presumbly, this very early fish fed on small living creatures. *Drepanaspis*, another ostracoderm, had a depressed head and a wide mouth. *Drepanaspis* may have sucked and shoveled in the mud and extracted the food from it partly by the action of the cilia.

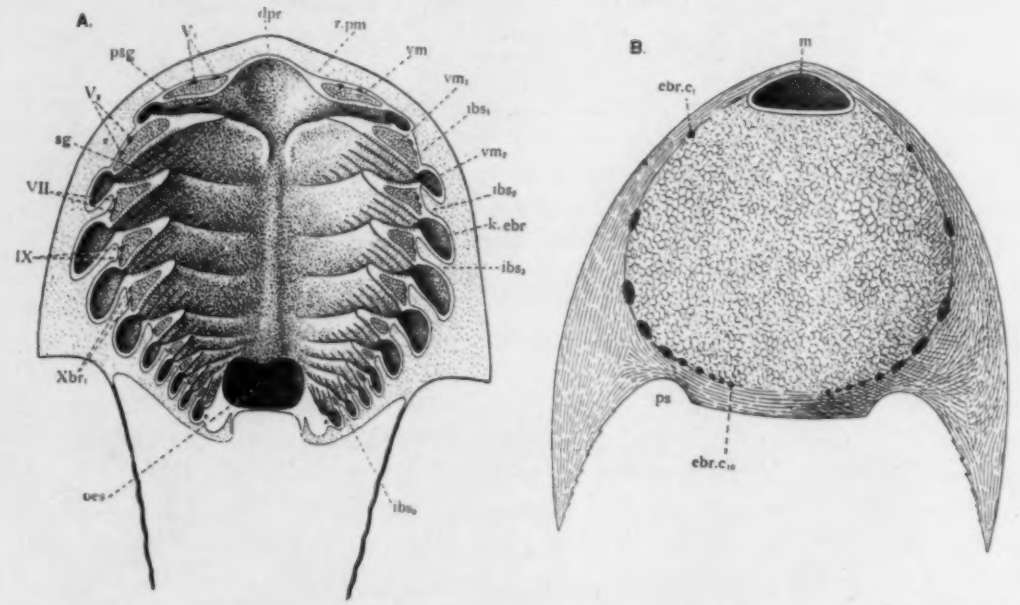


Fig. 3.—*A*, Attempted restoration by Stensiö showing the gill sacks (cut), roof of the pharynx and oral cavity (*dpr*) in a cephalaspid ostracoderm. The gill plates are restored as hanging down from the interbranchial septa *(ibs)*; the latter consisting of endoskeletal, bonelike material. *vm*, vm_1, etc., so-called visceral muscles operating the gill flaps; *oes*, oesophagus. *B*, Attempted restoration by Stensiö of the ventral surface of a *Cephalaspis* head-shield showing the mouth and gill openings *(ebr.* c_{1-10}*)*.

Some small ostracoderms called anaspids (Fig. 1, *A*) were elongate, apparently fast swimmers, with a blunt pincerlike piece at the tip of the lower lip-jaw. These fish may have caught shrimplike crustaceans. *Cephalaspis* (Fig. 1, *E*) had a domed head-shield, covering the brain trough and the capacious pharynx or chamber for the mouth and gills. There was hard endoskeletal tissue in the body wall (Fig. 3, *ibs*), around and between the gill pouches. Some of the ostracoderms had bonelike plates around the mouth which may have functioned either in scooping in the food or as pincers in seizing it, but apparently none of them had large internal jaws like those of sharks.

In sharks, the lower jaws (Fig. 4) are squeezed against the upper jaws, as two sticks set at an acute angle would be if we squeezed them together by grasping one end of the pair in our fist and contracting the flexor muscles of our thumb and fingers. Again, if we discard the sticks and just draw the thumb in toward the index finger, the thumb may represent the lower jaw, the index finger

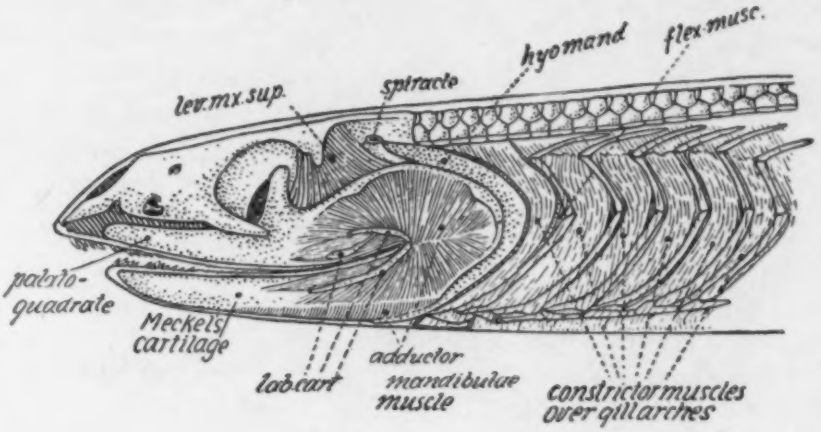
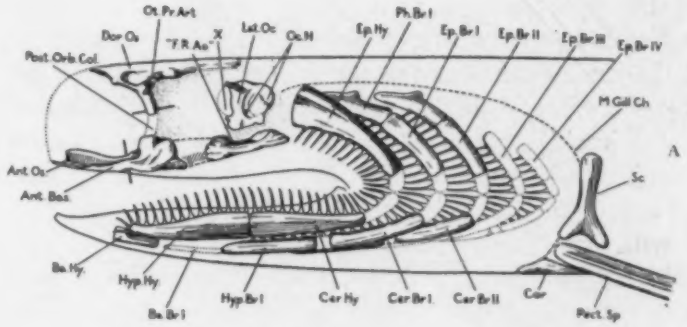


Fig. 4.



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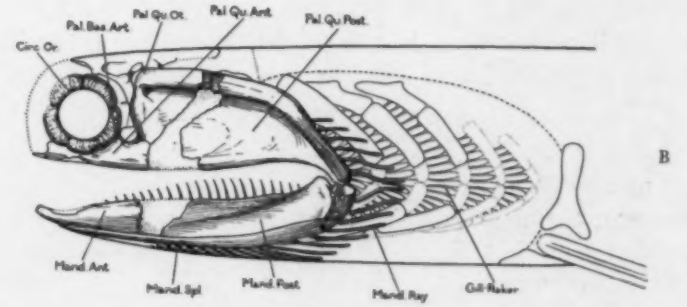


Fig. 4.—Skull, jaws, jaw muscles, and muscles of the gill arches of a shark, showing the essential similarity of the jaw muscles to the constrictors of the branchial arches. From Gregory, data after Allis.

Fig. 5.—Reconstructions of the inner *(A)* and outer *(B)* views of the skull, jaws, and gill arches of an acanthodian. The inner view *(A)* shows the segmented hyoid and branchial arches in series with each other; the outer view *(B)* shows the essential similarity of the segmented primary jaws to the hyoid and gill arches. (After Watson.)

the upper jaw. The thumb and the rest of the hand are pivoted against each other and they are based upon the forearm, somewhat as the larger and smaller branches of a lobster's claw are pivoted against each other and the whole based upon the entire limb. But fish jaws, although convergently resembling a lobster's claws in principle, were probably evolved in a flexible pharynx. Mobility seems to have been overemphasized in the modern lampreys and hagfishes. Here, the eversible lips are armed with thorny denticles for holding on to the victim, while the long and very muscular tongue carries a thorny rasp at its front end.

JAWS OF FISHES

The bony fishes have evolved a more complex jaw mechanism, evidently out of the ostracoderm ground plan. In the ostracoderms, only the floor of the mouth and throat, with its embedded small plates, was movable, and the gill pouches were surrounded by continuous endoskeletal partitions, without joints. In the sharks, acanthodians (Fig. 5), and bony fishes (Fig. 6), the skeleton around the mouth and gill pouches is subdivided into separated pieces which have movable joints between adjacent parts. This was a great advantage in the swallowing of other fishes, for the muscles of the gill arches could cooperate with those of the jaws in pulling the food toward the gut.

The jaws of bony fishes are very complex, with an inner more or less cartilaginous core called Meckel's cartilage and an outer shell of bony plates. The cores of the upper jaws were the palatoquadrate bars, which were connected by a ball-and-socket joint with the lower jaws. These inner upper and lower jaws are of the same nature as the gill arches and probably once carried gills, as did the hyoid arches, which were immediately behind the jaws (Fig. 5). In later forms, the hyoid arch lost its gills and was changed into a movable sling connecting the jaws with their base, which was the stout brain case.

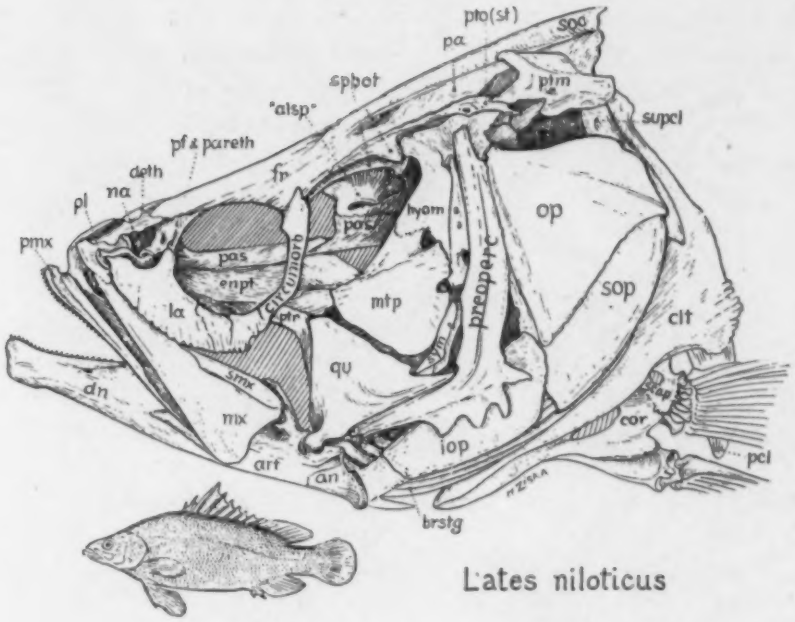
The surfaces of the inner jaws of bony fishes and crossopterygians (Fig. 7) are covered with bony plates upon which in turn the teeth are perched. The teeth probably represent the tubercles on the bony plates of some ostracoderms.

Much evidence, cited by Stensiö, Romer, and others, indicates that in the skeleton of sharks the embryonic cartilage jaws have been retained and enlarged, while the surface plates have been replaced by a thin hide of shagreen, bearing innumerable denticles; whereas, in the earliest bony fishes, the inner jaws form the core for many surface bones upon some of which the teeth are based.

PRIMITIVE PREDATORS

The line of ascent from air-breathing fishes to land-living quadrupeds appears to have run through or quite near to the crossopterygian or lobe-finned fishes of Devonian age (Fig. 8, *A*). In the earliest four-footed forms (Fig. 8, *B*), all the numerous bony plates of the lower and upper jaws correspond closely with those of their ancestors, the crossopterygian fishes. The more primitive of these labyrinthodonts, like their ancestors among the lobe-fins, were aggressive predators, with piercing teeth on the margins of the jaws. Their piercing teeth were strengthened by elaborate primary and secondary folds of the wall of the tooth (Fig. 9). The teeth were set in pits or sockets, and were surrounded by a cement layer.

Fig. 6.



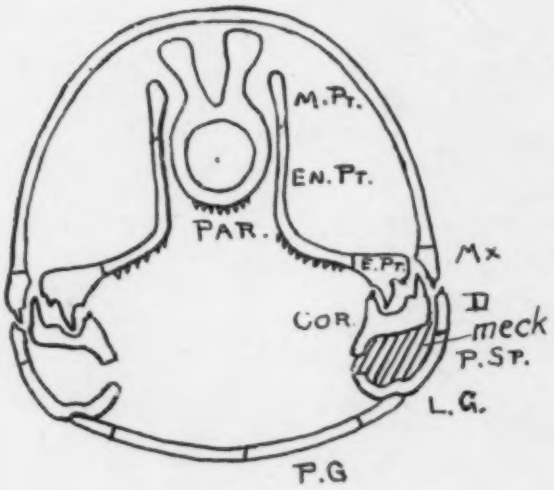


Fig. 7.

Fig. 6.—Skull and jaws of modern bony fish. The remnants of the "primary upper jaw" are the bones called entopterygoid *(enpt)*, palatine *(pl)*, pterygoid *(ptr)*, quadrate *(qu)*, and metapterygoid *(mtp)*. The suspensor for the lower jaw includes the hyomandibular, metapterygoid, quadrate, preopercular, and symplectic. The outer or so-called "lip jaws" include the premaxilla *(pmx)*, maxilla *(mx)*, and supramaxilla *(smx)*. The lower jaw includes the dentary *(dn)*, articular *(art)*, and angular *(an)*. (After Gregory.)

Fig. 7.—Cross section of skull of Devonian crossopterygian fish *Eusthenopteron*. Showing the inner or primary upper jaw plates on either side of the brain case, and the covering bones (maxilla *(Mx.)*, dentary *(D.)*, coronoid *(Cor.)*, etc. The "Primary lower jaw," Meckel's cartilage *(Meck)*, would have filled the empty space beneath the coronoid bone. (After Bryant.)

The earlier amphibians laid their eggs in the water as do their modern descendants, the frogs, newts, and salamanders; the newly hatched young were fishlike tadpoles, and their gill arches bore external gills. As the ages passed, the earliest reptilian or lizard-like types were evolved out of amphibians. These reptiles laid their eggs on land. The jaws and teeth of the earliest reptiles, however, differed only in form and detail from those of the earliest amphibians.

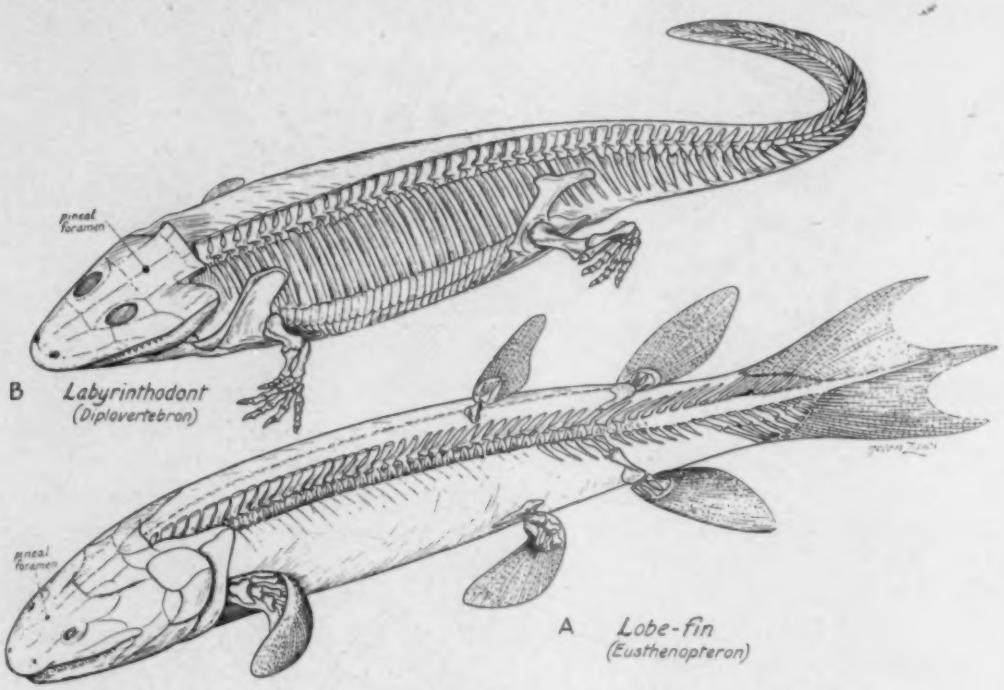


Fig. 8.—Devonian lobefin (crossopterygian, *A*) and early carboniferous tetrapod (*B*). (Restorations, after Gregory.)

In the line of reptiles that led to the mammals, the earliest reptilian forms were called pelycosaurs; they lived in the carboniferous or coal age and in the succeeding or Permian age. They had lizard-like jaws, with sharp teeth adapted for flesh eating. Essentially similar were the oldest carnivorous mammal-like reptiles of South Africa and Russia.

AN EARLY ORTHODONTIC MECHANISM

All the earlier reptiles possessed what I have named the five-way palatal brace (Fig. 10, *A2*). In this orthodontic mechanism there were paired descending flanges on the pterygoid bones of the upper jaw. The dorsal surfaces of the flanges served as firmly placed, rounded surfaces over which ran the strong pterygoid muscles (Fig. 11, *B*). These muscles were attached near the rear ends of the lower jaws and helped to snap the lower jaws upward. The outer sides of the descending pterygoid flanges had smooth lateral surfaces which were closely parallel to the inner sides of the lower jaw. When the jaw was adducted, the smooth pterygoid flanges would prevent any lateral dislocation of it, due to the struggles of the living prey.

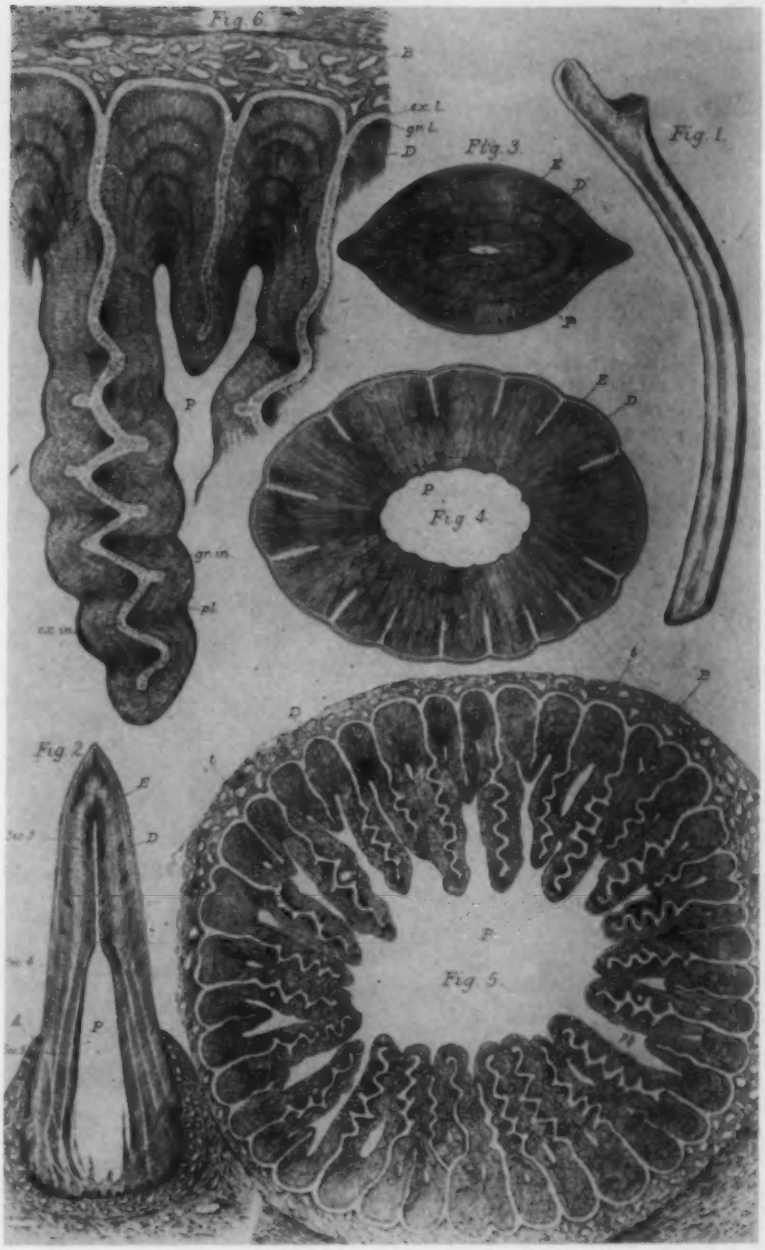


Fig. 9.—Cross-sections of labyrinthodont teeth. (From Gregory, after Embleton and Atthey.)

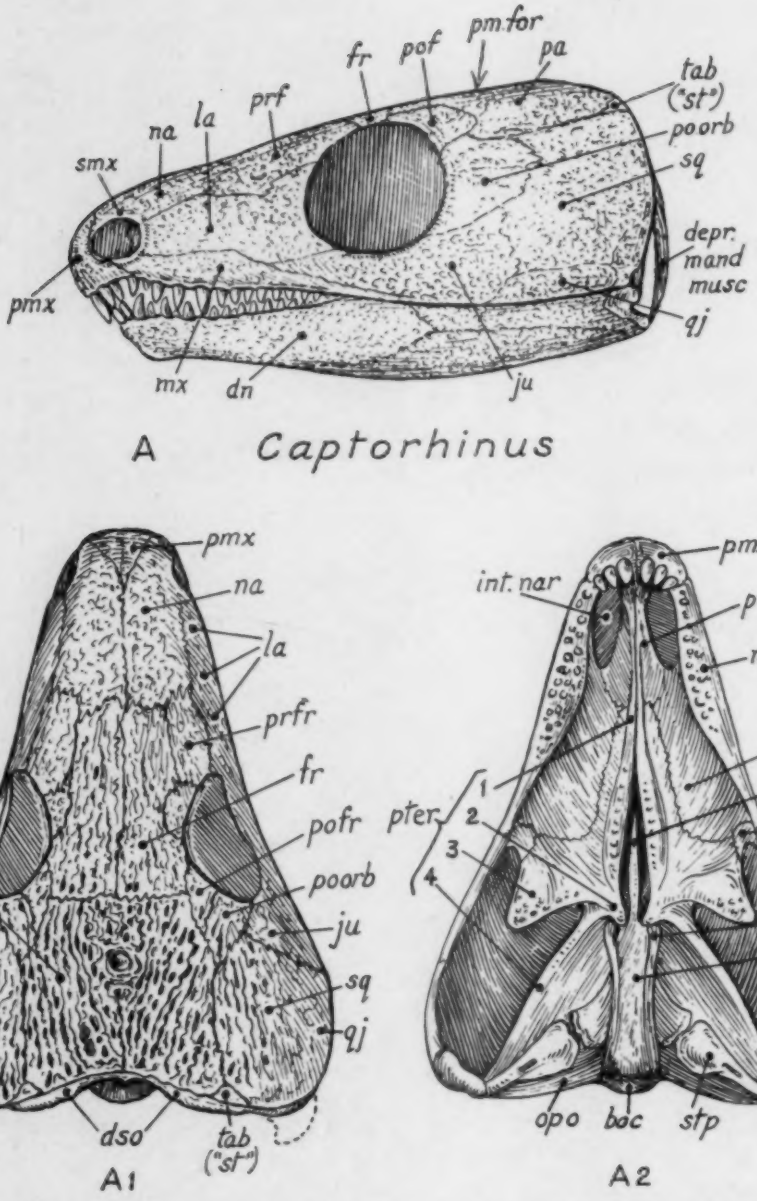


Fig. 10.—Skull of a very primitive reptile of the Permian period. Four of the five branches of the pterygoid (*pter 1, 2, 3, 4*). The fifth or vertical branch runs dorsally beneath branch 2. (After Gregory.)

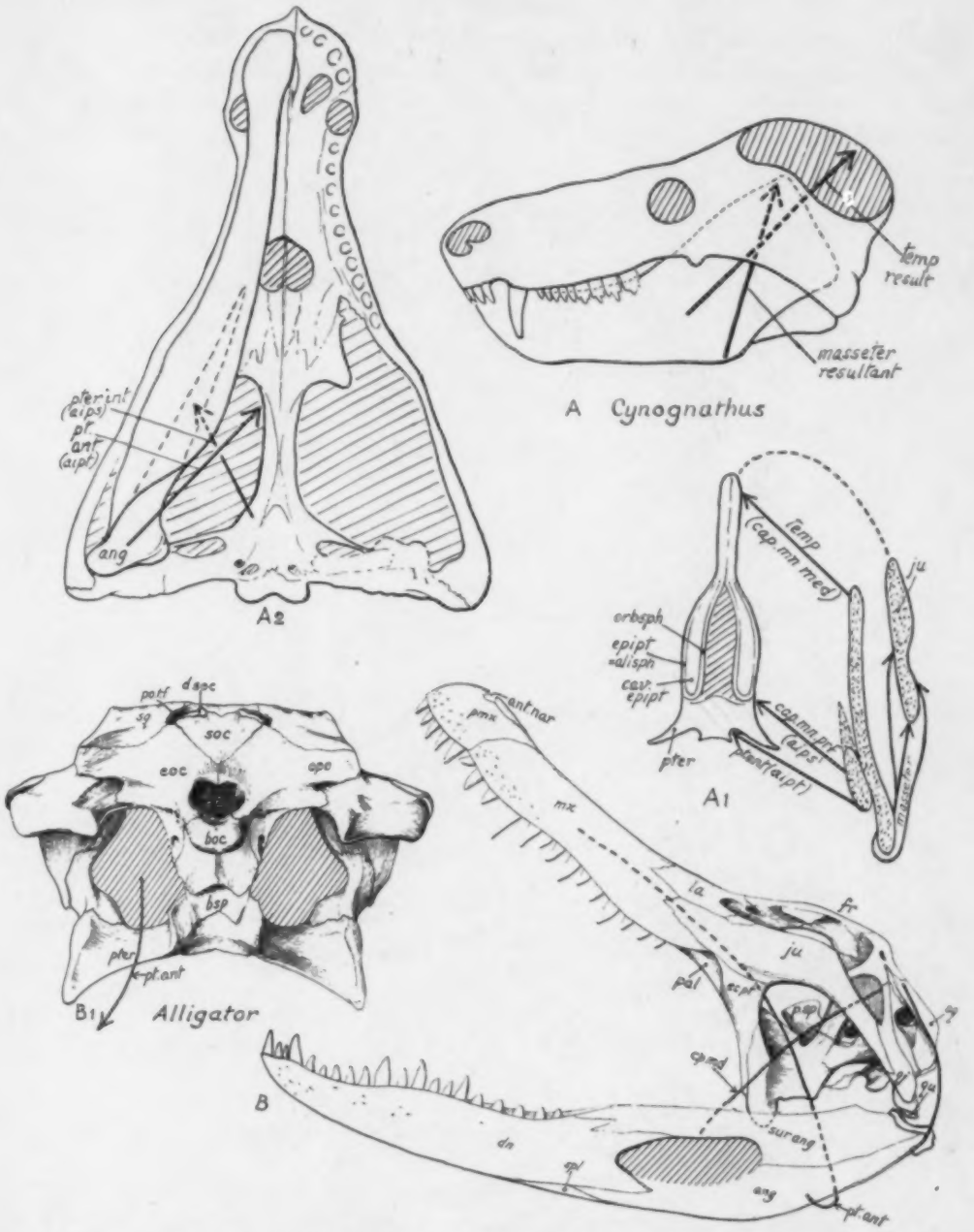


Fig. 11.—*A*, A_1, A_2, Jaw muscles of cynodont. Skull data from Seeley, Broom, Broili; muscle data from L. A. Adams, Parrington, and Westoll. *Aips*[1], adductor internus pseudotemporalis.

B_1 and B_2, Relation of the pterygoid muscle (*pt. ant.*) to the descending flange of the pterygoid (*pter.*) in a modern reptile. *cp. mn.*, Capitimandibularis muscle. The black line beneath the quadrate *(qu)* indicates the course of the depressor mandibularis. (After Gregory.)

The little hamular or pterygoid plates in man and other mammals (Fig. 12, *B*) represent greatly reduced remnants of this once dominant palatal brace of our very remote ancestors among the older mammal-like reptiles. The reduction of the five-rayed pterygoid brace is seen in the cynodonts or higher mammal-like reptiles (Fig. 12, *A*) of the Triassic age in South Africa and Russia. Each of the other four branches of this primitive palatal brace had its own special function.

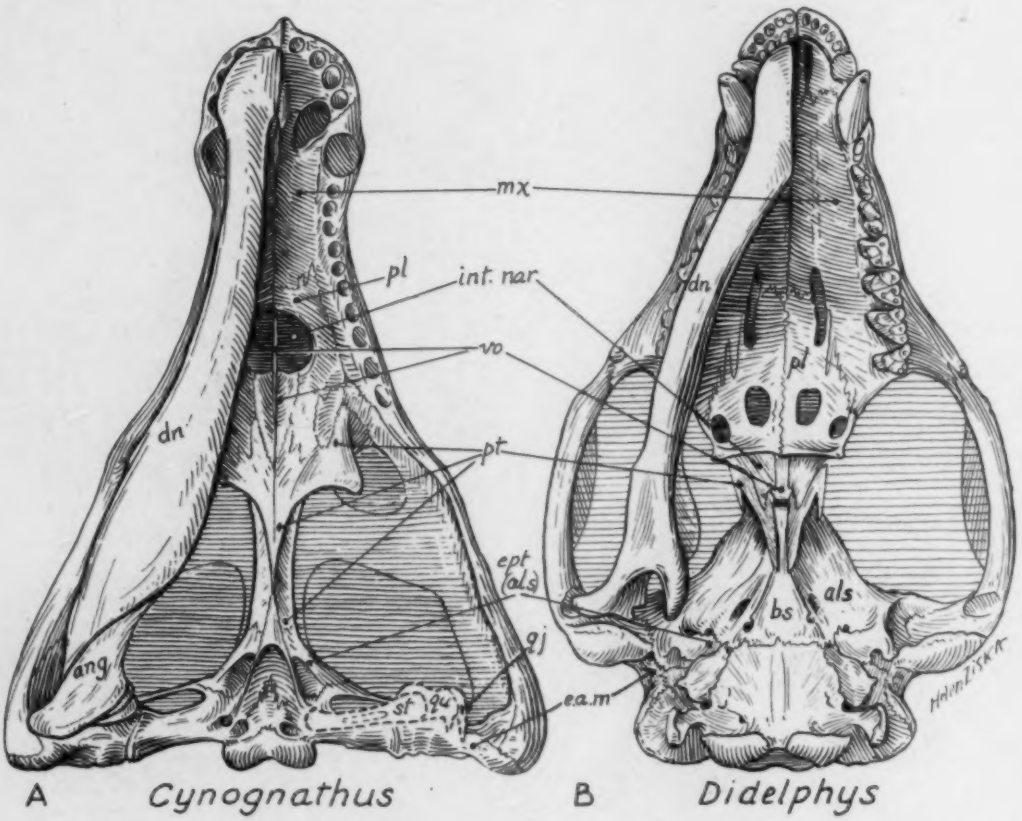


Fig. 12.—Palatobasal aspect of skulls in Triassic cynodont *(A)* and modern opossum *(B)*. (After Gregory; data for *A* from Broili and Schröder.)

PREMAMMALIAN STAGES

An amazing series of changes in the jaws and teeth took place during the late Permian, Triassic, Jurassic, and Cretaceous periods, as certain lines of the extinct mammal-like reptiles were transformed into mammals. In the earlier members of this series (Fig. 13, *A* and *B*), the lower jaws were fundamentally like those of alligators and each half was composed of seven pieces. In the upper jaw, the five-rayed pterygoids were still present, but neither the descending flanges nor the branches that connected the pterygoids with the quadrates were as conspicuous or strongly developed as they were in the founders of this line.

In a later stage (Fig. 13, *B*), the dorsal branch of the dentary bone on either side began to overlap the surangular bone behind it. Still later, this dorsal or ascending branch of the dentary became very large and was directed more and more upward (Fig. 13, *C*).

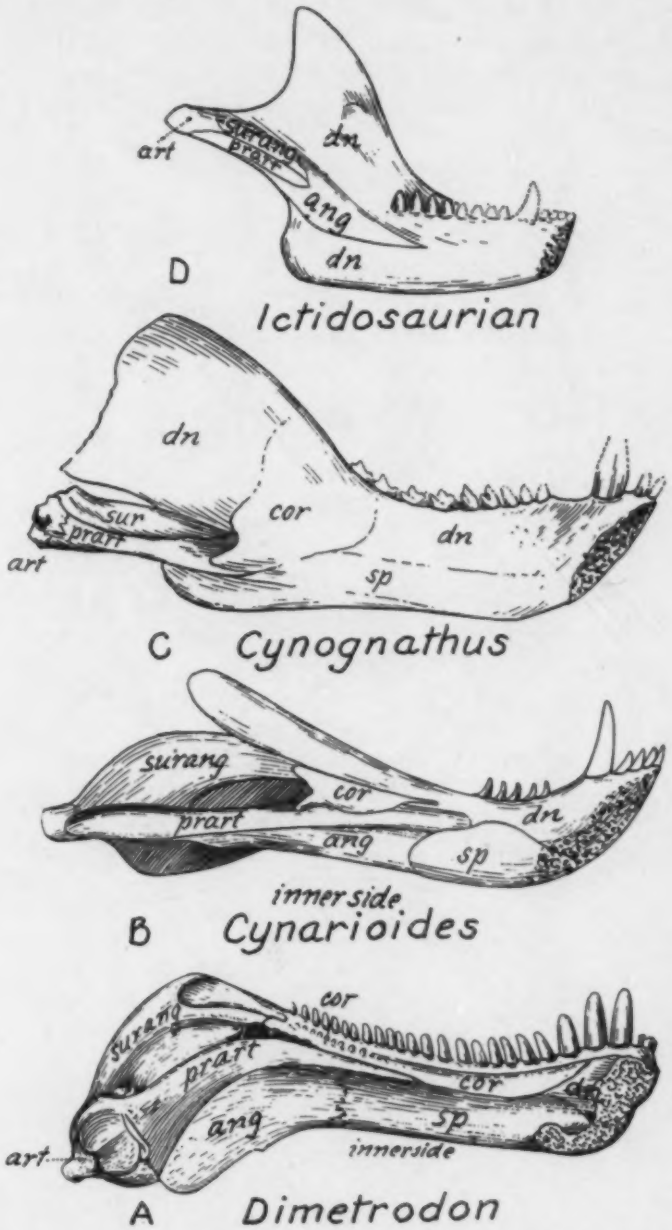


Fig. 13.—Transformation of lower jaw in extinct mammal-like reptiles. (From Gregory. *A*, after Williston; *B* and *D*, after Broom; *C*, data from Broom, Watson and Broili.)

Meanwhile, a sagittal crest was developing on top of the skull, as the temporal muscles greatly increased in cross-section and strength; at the same time, the rear branch of the pterygoid bones diminished (Fig. 11, *A2*) and pre-

sumably part of the pterygoid muscles likewise diminished. The older "reptilian" joint (Fig. 14, *A*) between the quadrate and quadratojugal bones of the upper jaw and the articular bone of the lower jaw was reduced in size (Fig. 14, *B*), as were the quadrate and articular bones themselves. This process continued until the ascending branch of the dentary on each side almost or quite touched the squamosal bone, which had become very large and strongly braced against the side and rear end of the skull. Thus by slow degrees a new jaw joint was developed between the dentary bone below and the squamosal above (Fig. 14, *C*).

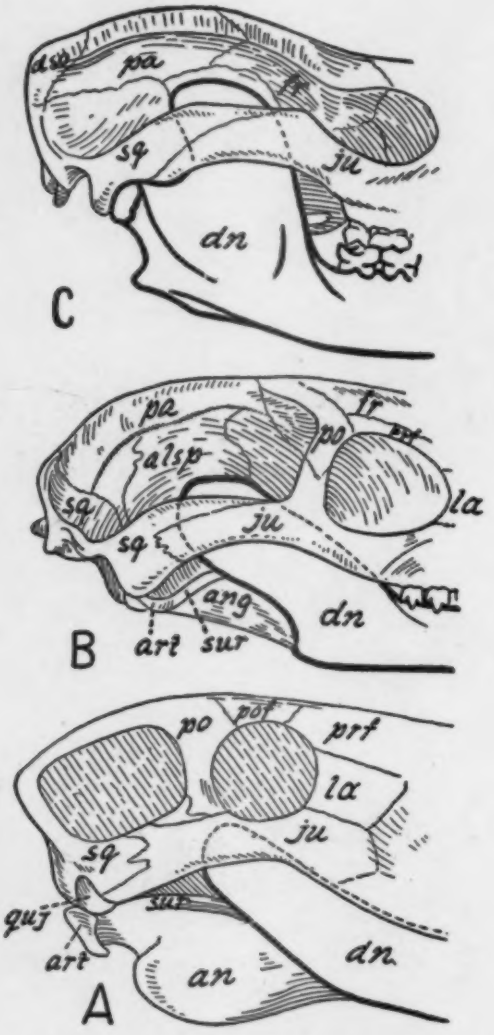


Fig. 14.—Three stages in the origin of the temporomandibular joint. *A*, primitive mammal-like reptile; *B*, advanced mammal-like reptile (cynodont); *C*, primitive mammal (opossum). (After Gregory.)

Thus arose what may be called the one-piece half jaw of mammals, which had been simplified from the seven- or eight-piece half jaw of primitive reptiles. As the new and distinctively mammalian or "temporomandibular" joint increased,

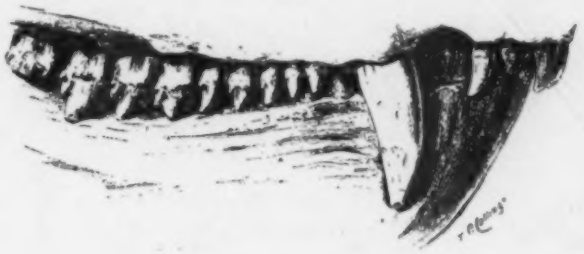
the old or reptilian quadrato-articular joint behind it diminished and was gradually taken over into the middle ear, where the quadrate was transformed into the incus and the articular into the malleus.

All this has been well established by the converging lines of evidence from paleontology, embryology, morphology, and the study of the successive stages in the function of each of the parts involved. At the beginning of this slow transformation, the reptiles concerned were lizard-like; near the final stage the jaws were more mammal-like than lizard-like.

SHEAR AND INTERLOCK

The teeth in the earlier mammal-like reptiles were like flattened pegs with slightly recurved crowns, set in sockets and adapted for seizing and lacerating living prey. When we reached the stage of the larger cynodonts (Fig. 15), the teeth were well differentiated into incisors, canines, premolars, and molars, the latter with compressed bladelike crowns. The blades already bore several distinct serrations or incipient cusps. The excursion of the mandible was in the vertical longitudinal plane with very little or no side slip.

Fig. 15.



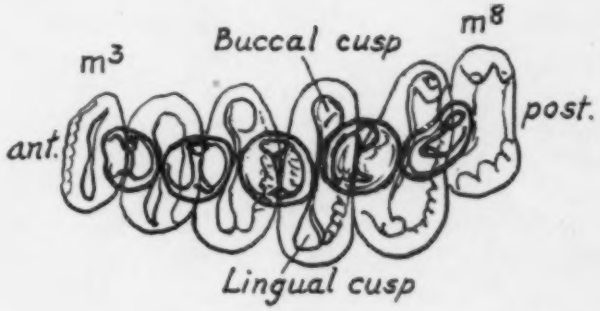


Fig. 16.

Fig. 15.—Upper incisors, canines, premolars, and molars of a large advanced mammal-like reptile (*Cynognathus*). (After Seeley.)

Fig. 16.—Molar occlusion diagram of a gomphodont. (Data from Seeley and Broom.)

Nearly allied with the carnivorous cynodonts were the supposedly omnivorous or carrion-feeding gomphodonts. In these forms, the crowns of the upper cheek teeth, as we pass backward from the anterior premolars, were gradually

widened into transversely wide ovals (Fig. 16). Each oval crown bore a low cross-crest. The lower molars were much narrower transversely than the uppers, but they also bore small low transverse ridges, which in occlusion fitted between the large ridges of the upper molars. Although the gomphodonts may not have been directly ancestral to mammals, their dental apparatus foreshadowed the central mammalian stage, in the following features:

1. In occlusion, the lower molar crowns interlocked with the uppers so that each lower molar articulated with two upper molars.

2. In occlusion, the upper molars projected buccally far beyond the lower molars.

3. The transverse crests of the lower molars tended to press the food into the space between the crests of two upper molars.

4. The wider upper molar series as a whole served as a fixed base toward which the smaller, moving lower molars were squeezed against and into the food. The smaller bones in the prey would be broken by the swift impact of the lower jaw, just as a stick with its ends supported by two blocks breaks in the middle under the stroke of the hatchet.

5. The excursion of the mandible in a vertical plane was probably caused by an X-like arrangement of the temporal and masseter muscles in the side view and in the rear view by a V-shaped muscular sling consisting of the masseters and the internal pterygoid muscles (Fig. 11 *A*, A_1).

The links of Upper Triassic age connecting the mammal-like cynodonts with the typical mammals are still at best but poorly known. When we come to the Jurassic triconodonts (Fig. 17, *A B C*, and *D*) and symmetrodonts (Fig. 17, *E* and *F*), we find carnivorous shearing teeth, recalling those of the cyrodonts, while, in the opposite direction, typical pantotherians (Fig. 18) have progressively widened upper molars and small wedge-shaped lower molar crowns. In occlusion, these lower molar crowns wedged in between the cross crests on the upper molars, recalling the gomphodonts.

Amphitherium (Fig. 18) of this Jurassic group had a very generalized mammalian lower jaw and teeth. Its lower molar crowns were narrower transversely and longer mesiodistally than the uppers; the crowns were supported by well-separated anterior and posterior roots. The main high lower cusp lay on the buccal side and was the largest part of the trigonid or three-cusped wedge. The rear base of the crown bore a small concavity or talonid basin projecting backward.

In occlusion, the lower wedges or trigonids of pantotherians fitted between the cross crests of the upper crowns, while the palatal tubercle of the uppers pressed the food into or toward the talonid basin of the lowers.

From this stage onward the more conservative kinds of mammals retained traces of the fundamental occlusal pattern just described. These were insectivorous, carnivorous, and omnivorous forms.

As vegetable life is on the whole far more abundant than animal life and must stand still while the animals come and feed upon it, it was inevitable that herbivorous forms should develop again and again in different mammalian orders from omnivorous ancestors; also that herbivores (in the wider sense, including rodents) should be far more numerous than carnivores.

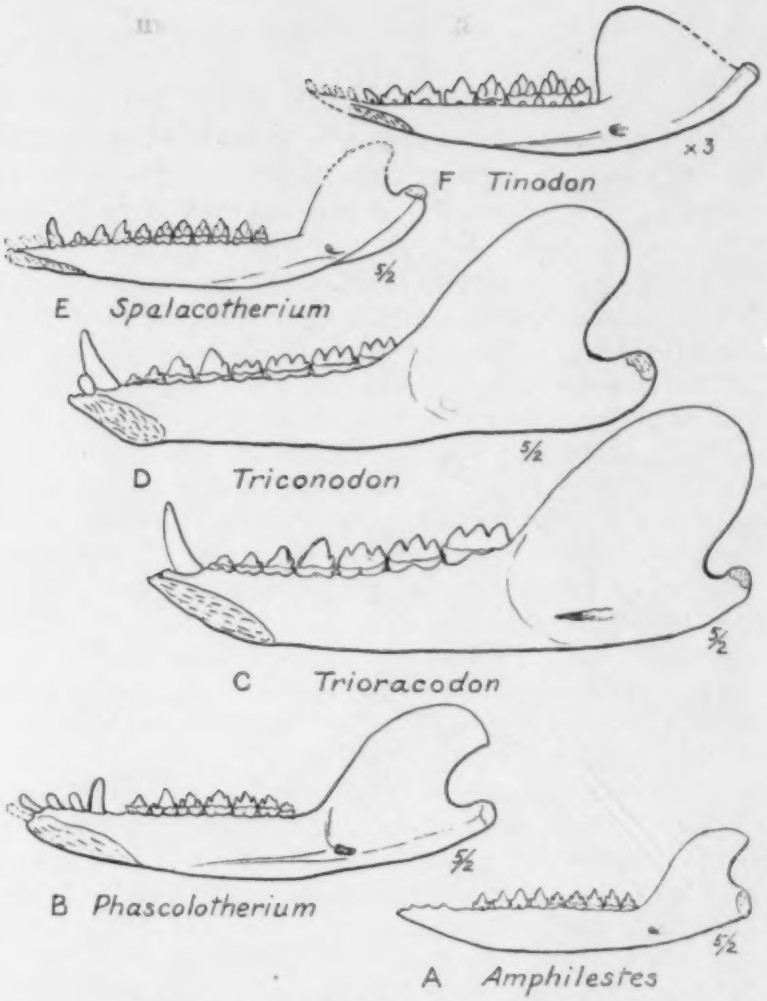


Fig. 17.—Lower jaws of Jurassic triconodonts *(A-D)* and symmetrodonts *(E* and *F)* Lingual aspect of right half. (After Simpson.)

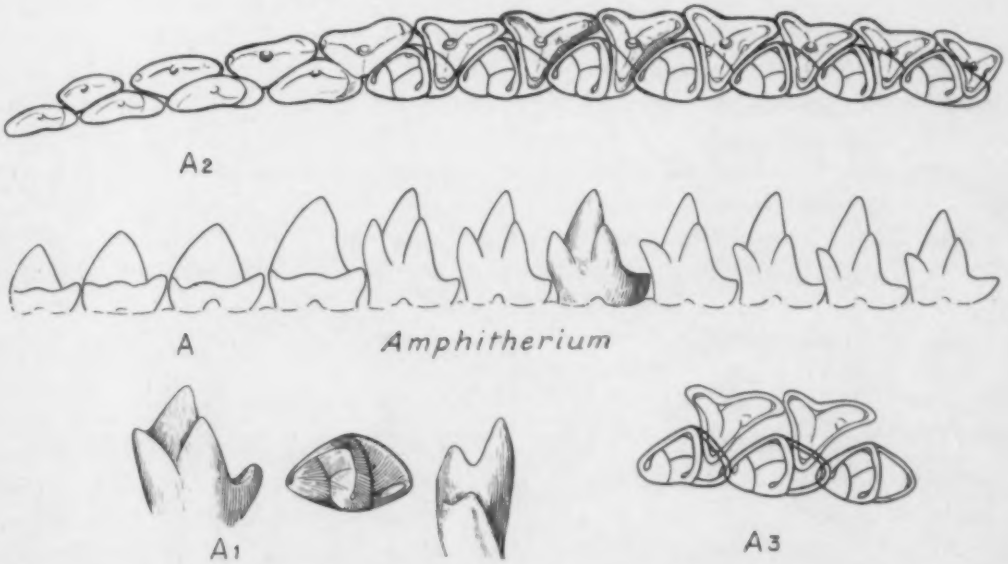


Fig. 18.—Lower teeth of *Amphitherium (A* and A_1*)* with unknown upper teeth *(*A_2 and A_3*)* restored by comparison with other pantodonts, to fit lowers.

LOSS OF PARTS WITH CHANGE OF FUNCTION

Thus we have arrived at a central type of dentition and occlusion which branched into many widely different orthodontic systems. Of all these, I shall select for present consideration only the line that culminated in the mammoths and elephants.

During the course of divergent evolution, one or more parts of the ancestral orthodontic mechanism may be so much changed or shifted that it may get out of contact with its opponent and lose its original orthodontic status. The tusks of the elephant, for example, have lost their former mates in the lower jaw. In the remote fossil ancestors of the elephants there were four incisor tusks (Fig. 19, *B*), two in the upper and two in the lower jaw, and these were opposed to each other and resembled rather the chisel-like front teeth of a beaver. In the course of ages, however, the lower pair lost their sharp curvature and began to point rather forward than upward (Fig. 19, *C*); meanwhile, the upper pair were also becoming less curved, but, as the width across their alveoli increased faster in the upper jaw than in the lower, the tips of the uppers gradually passed laterally beyond those of the lowers, so that the primitive occlusal relations were lost. Meanwhile, the upper and lower tusks were being differently influenced by the great growth of the muscles of the upper lip and nose which tended to form a strong muscular proboscis. This proboscis (Fig. 19, *C*) at first cooperated with the increasingly strong tongue; as the forward protrusion of the tongue increased, the lower incisors became more inclined forward and they later became aligned on either side of the median bony channel for the lower surface of the tongue. Still later (Fig. 19, *D*), the proboscis became sufficiently strong to take over the functions formerly performed by the end of the tongue; as this happened, the tip of the tongue diminished and retreated toward the rear, the lower tusks dwindled and eventually disappeared and the front end of the lower jaw greatly shortened up (Fig. 19, *E*).

I cite this case as an illustration of a wide principle: that after Nature has built up a perfected orthodontic system through millions of years, she is very apt first to overemphasize and then to modify and eventually to discard at least some of the parts of it. In man, for example, the failure of one or more of the wisdom teeth to erupt may, in the remote future, disturb the sensitive equilibrium of normal occlusion. The variability of the size and shape of the third molars even in primitive human jaws also suggests that the tooth is now in a declining phase. If the human race does not, in the meantime, commit suicide, the dentists of the distant future may have less frequently to deal with cases of impacted third molars, but the orthodontists may have more problems, due to the second molars having room to drift away from the first molars.

ORTHODONTY AND OCCLUSION

As could be shown at much greater length, orthodontic systems in nature constitute a class of animal mechanisms in which one or more movable mouth parts, with or without teeth or toothlike projections, are squeezed or pulled toward each other by the contraction of special muscles; and they are thus brought

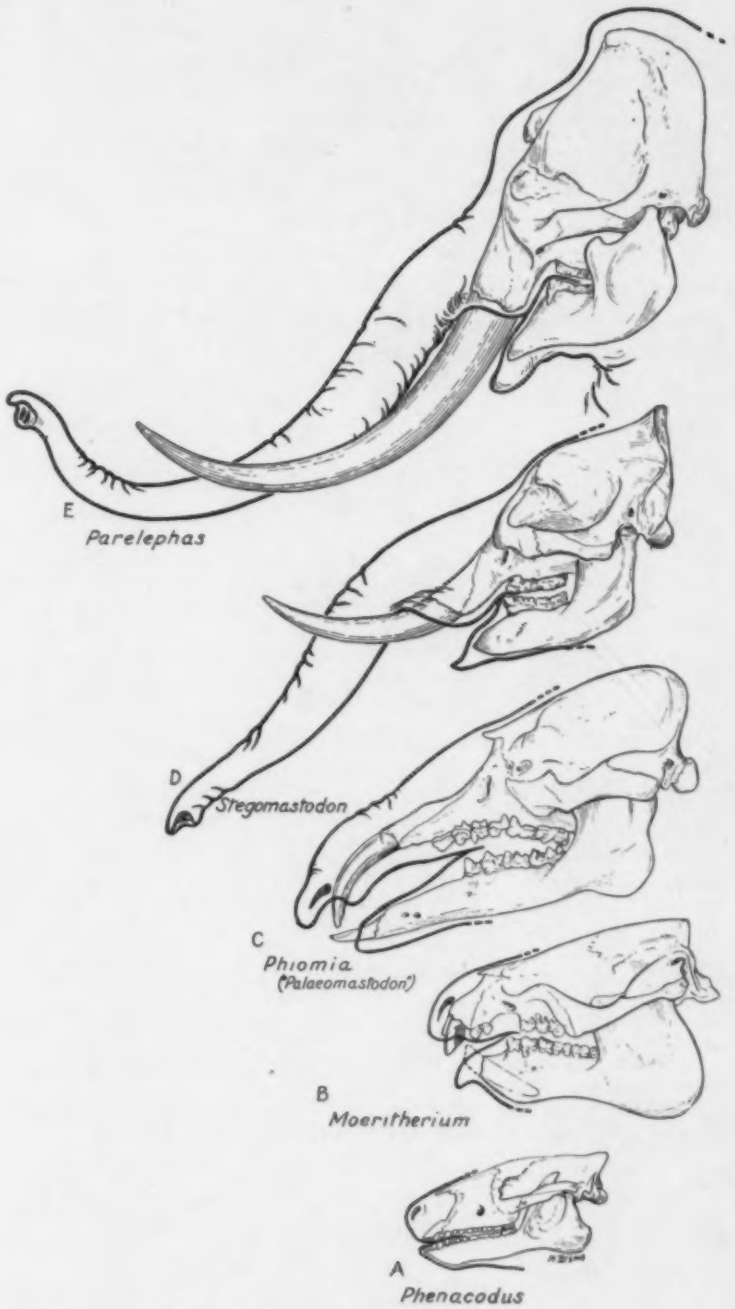


Fig. 19.—A structural series of fossil proboscideans (*B*, *C*, *D*, and *E*), indicating the progressive emphasis of the nose-lip and upper incisor tusks, the increase (*A*, *B*, and *C*), and elimination (*D* and *E*) of the lower incisors and their alveolar bone. *A*, primitive Eocene ungulate with unreduced dentition.

into effective opposition with the food. Among the conditions of effective opposition, one is that the curves or paths described by the moving part, as well as the topography of the opposing parts, are all so adjusted one to the other that, when the upper and the lower jaws or jawlike parts are closed, the shearing surfaces, elevations, or depressions of one shall closely articulate with the opposing parts of the other, as a key fits into a lock.

In such natural orthodontic mechanisms, the central problem of securing effective occlusion has been solved first by limiting or predetermining in various ways the paths traversed by the moving parts and second by establishing inverse or mirror image relationships between the occluding surfaces. Thus, from the viewpoint of an historian of natural evolution, orthodontic success is proportional to the degree in which effective occlusion is attained.

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THE REHABILITATION OF CLEFT PALATE PATIENTS

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INTRODUCTION

IN PRESENTING this subject to the American Board of Orthodontics, the author has a twofold purpose. The thesis presents a résumé of an orthodontic program as carried out in Nebraska by the State Services for Crippled Children in cooperation with the College of Dentistry of the University of Nebraska. Since this program may be used as a pattern for similar programs in other states, we present this report to the American Board of Orthodontics for its consideration of the merits of the program described, as well as for any scientific material which the report may contain.

A consideration of the surgical procedures involved in the repair of cleft palates is not a part of the discussion in this thesis. We are aware of the existence of several methods of such surgical repair; our discussion, however, will deal only with the rehabilitation of the patient with relation to the dental problems confronted in the orthodontic correction and final construction of a suitable replacement. Before entering into a discussion of our recommendations regarding the treatment of such cases, may we present a brief history of the care of crippled children in Nebraska, and explain how the present program has been expanded to include orthodontics.

THE STATE PROGRAM FOR CRIPPLED CHILDREN

Nebraska was one of the first states to recognize the state's responsibility to its crippled children. Minnesota and New York preceded Nebraska by a few years in establishing such a program, but in 1905 a Nebraska State Orthopedic Hospital was established at Lincoln, and in this institution since that date Nebraska's crippled children have been cared for at state expense. Since Nebraska was one of the pioneers in recognizing the state's responsibility in these matters, it is only natural that she should be one of the states first to work out a plan for the extension of that program to include dental care and the rehabilitation of cleft palate cases.

In 1935, the Social Security Act was passed, giving Federal aid to the states to be used in improving the care of crippled children. Up to 1936, however, nothing had been done to include cleft palate cases in the crippled children's program. There were, however, some cases handled by the staff of the State Orthopedic Hospital, but the majority of cleft palate cases were treated at the State University Hospital in Omaha, their treatment being under the

This thesis was written expressly for the American Board of Orthodontics in fulfillment of partial requirement for certification.

direction of Dr. William Shearer. Dr. Shearer is now directly associated with the crippled children's program, and performs all staphylorrhaphies for children coming under the Crippled Children's Service.

In 1937, a new state law was enacted, organizing a State Assistance Department, which department was placed under the supervision of the State Board of Control. Following the enactment of this new law, all cases involving crippled children which came under the State Assistance Department were sent to the State Orthopedic Hospital at Lincoln. This program now included cases of cleft palate; such cases, however, were sent directly to Emanuel Hospital in Omaha, where they were placed under the care of Dr. Shearer.

The revised program of 1937 very definitely included the cleft palate case, but there was nothing in the program to include dental care or rehabilitation of the patient following the closure of the palate. When attention was called to this fact, it was soon realized that the state's responsibiliy should not end with the closure of the palate. A broader plan of rehabilitation was necessary if the state was to assume its obligation to these unfortunate individuals.

In fulfillment of this obligation, Dr. E. W. Hancock, then Supervisor of Medical Care Policy and now Chief of Service for Crippled Children, Dr. Fred W. Webster, Dental Adviser to the State Board of Control, and Mrs. Pauline Ryman, Medical Social Consultant, devised a plan to include dental service following the staphylorrhaphy. This service was made possible through an arrangement worked out with the College of Dentistry of the University of Nebraska. Through the cooperation of Dean Bert L. Hooper, Dr. Ralph Ireland, and Dr. Paul G. Ludwick, the author of this paper, a very definite program was worked out to make this dental service available to cleft palate patients.

ORTHODONTIC CARE IN STATE PROGRAM

Prior to the inclusion of orthodontic treatment in the Nebraska Crippled Children's Service, a large number of cleft palate cases had been treated, but the treatment ended with the closure of the palate. No orthodontic service was provided for these children, in spite of the obvious need for such service. As a result, many of these cases were neglected and unless private service was supplied the patients went untreated. As has been indicated above, the need for including a dental program following the staphylorrhaphy was obvious, since the need for dental services for these children was not being met. It was not the intention of the Crippled Children's Service to try to meet this problem completely, but merely to design a plan which would fulfill its obvious responsibility to those children whose palates had been closed and whose rehabilitation program was incomplete because of orthodontic defects. This service, later on, was made to include cases other than those involving the cleft palate. Such cases included only those coming under the Crippled Children's Service and only those cases which could be further benefited by orthodontic treatment. Some few of these cases are now in treatment. Availability of the patient for active treatment and the probable beneficial effect of such treatment governs in a large measure the advisability of orthodontic care. Many of these cases are compromise cases, since the advisability of complete treatment is questionable.

CASE FINDING BY CRIPPLED CHILDREN'S SERVICE

Before explaining in detail the workings of this program, may we state that each of the ninety-three counties of the state has a county assistance office with one or more social workers. These workers act in a case-finding capacity in cooperation with the local physician. As a result of the activities of the workers and the physician, patients are referred to the State's Assistance Department, where there is a medical social consultant whose general duties include social planning with the worker, the parent, and the child. Under such a plan, one can readily see that the program is complete and that the interests of the patient are always paramount. Social workers are instructed and familiarized with the merits of the complete details of treatment of the child's case, so that upon contact with the family the worker can readily present the plan in an intelligent manner, and thus win the family's confidence and cooperation.

CRIPPLED CHILDREN'S SERVICE AND THE UNIVERSITY OF NEBRASKA COLLEGE OF DENTISTRY

Upon the background of this review of the history and development of the present plan of the Crippled Children's Service to include dental care, we may now present in detail the program as it is at present operating in conjunction with the College of Dentistry of the University of Nebraska.

As a result of personal contact with the family by the social worker, or through a former contact with the Crippled Children's Service, the patient is instructed to appear at a definite time at the State Orthopedic Hospital. The patient receives a routine checkup by the staff, under the supervision of the chief pediatrician. If the patient's general condition is found suitable, he is released to appear at the College of Dentistry for orthodontic service. The term *orthodontic service* is used in the plan and is meant to mean a broad program of dental rehabilitation. This service is to include all services necessary to that end.

NATURE AND COST OF ORTHODONTIC TREATMENT

The outline of the services to be rendered may be stated thus:

A. Examination and Diagnosis
   A routine dental examination, including prophylaxis; full-mouth roentgenograms, bacteriologic examination, including sputum count; record models, photographs, and complete case history.

B. Operative Procedures
   Preparation and repair of all cavities, as well as the treatment of any gum irritations or lesions.

C. Surgical Procedures
   All extractions and any plastic procedures on the gums or frenum labium.

D. Appliance Construction and Placement
   Complete orthodontic diagnosis, and the fabrication and placement of the appliances. This is to include the subsequent treatments during the period of active treatment.

E. Construction of Replacements
   Construction of the temporary or final replacements.

Fig. 1.—Before treatment.

Fig. 2.—After treatment.

Fig. 3.—Before treatment.

Fig. 4.—After treatment.

Fig. 5.—Before treatment.

Fig. 6.—Before treatment.

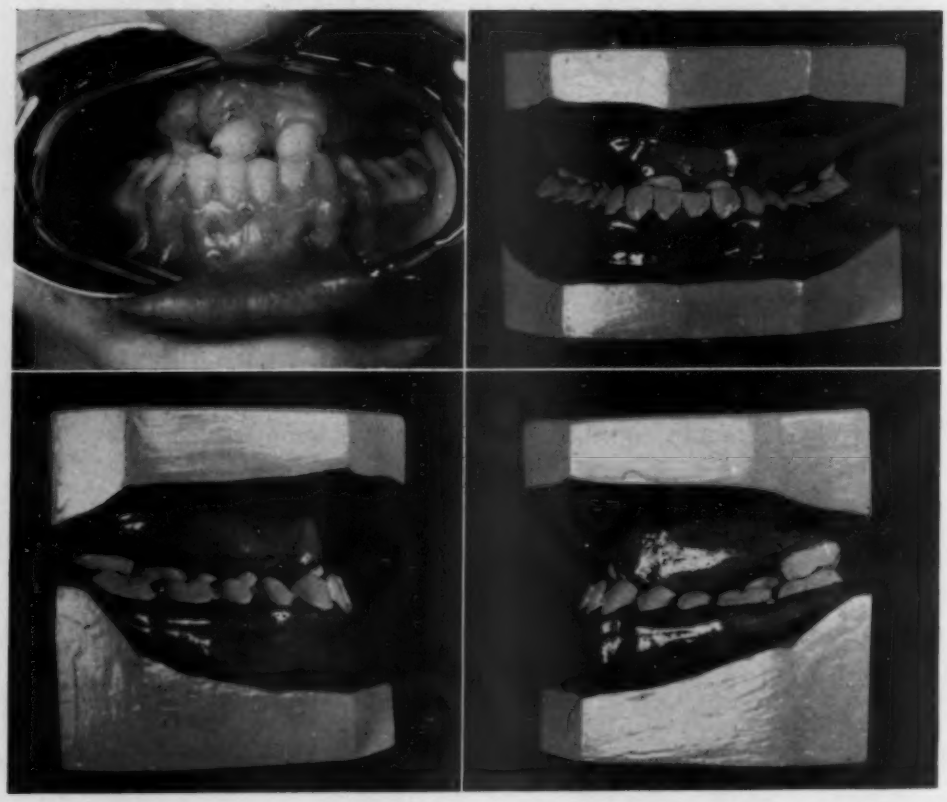


Fig. 7.—Before treatment (right side).

Fig. 8.—Before treatment (left side).

Children coming under the Crippled Children's Service but who do not require hospitalization are cared for in convalescent homes. These facilities are available to dental patients as well. Thirty days' foster care is thus provided, which gives ample time to carry the patient through diagnosis, operative care, and placement of appliances. In most cases, the parent or guardian is responsible for the transportation of the patient during the active treatment period, but provisions are made whereby the county assistance department may help if such help is necessary. Hospitalization, when necessary, is provided at the Nebraska Orthopedic Hospital for the cleft palate case under the same conditions as for other children.

Fig. 9.—Before treatment (occlusal). Fig. 10.—After treatment (occlusal).

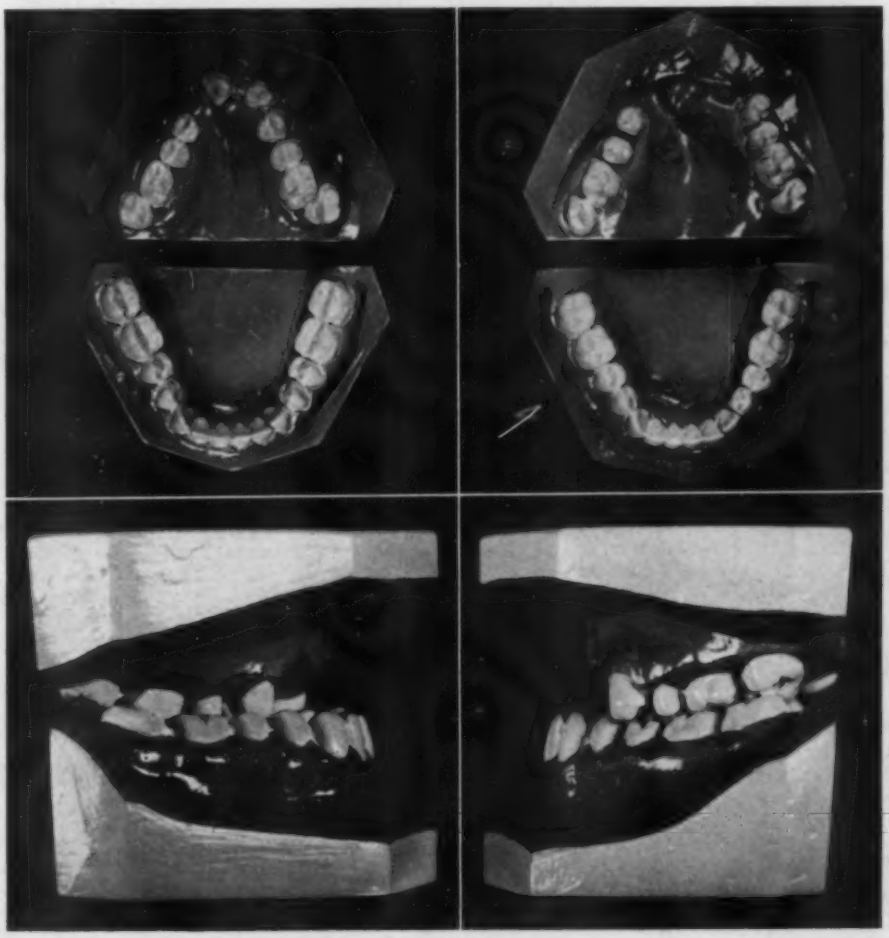


Fig. 11.—After treatment (right side). Fig. 12.—After treatment (left side).

The Crippled Children's Service provides that each major case be paid for on a basis of a maximum cost of $125. The basis for arriving at this average is contained in the dental estimate of costs prepared by the College of Dentistry.

Payments are divided as follows:

1. Examination and diagnosis	$10
2. Operative procedures	$25
3. Surgical procedures	$20
4. Appliance construction	$30
5. Prosthodontics	$20
6. Checkup (two visits second year)	$20

The entire staff of the College of Dentistry is available for this dental service for the individual case, and each department plans the work which falls under its supervision. All department chiefs consult each other freely in planning the treatment, keeping in mind the welfare of the patient through seeing that the best results are obtained.

Fig. 13.—After treatment.

Fig. 14.—After treatment.

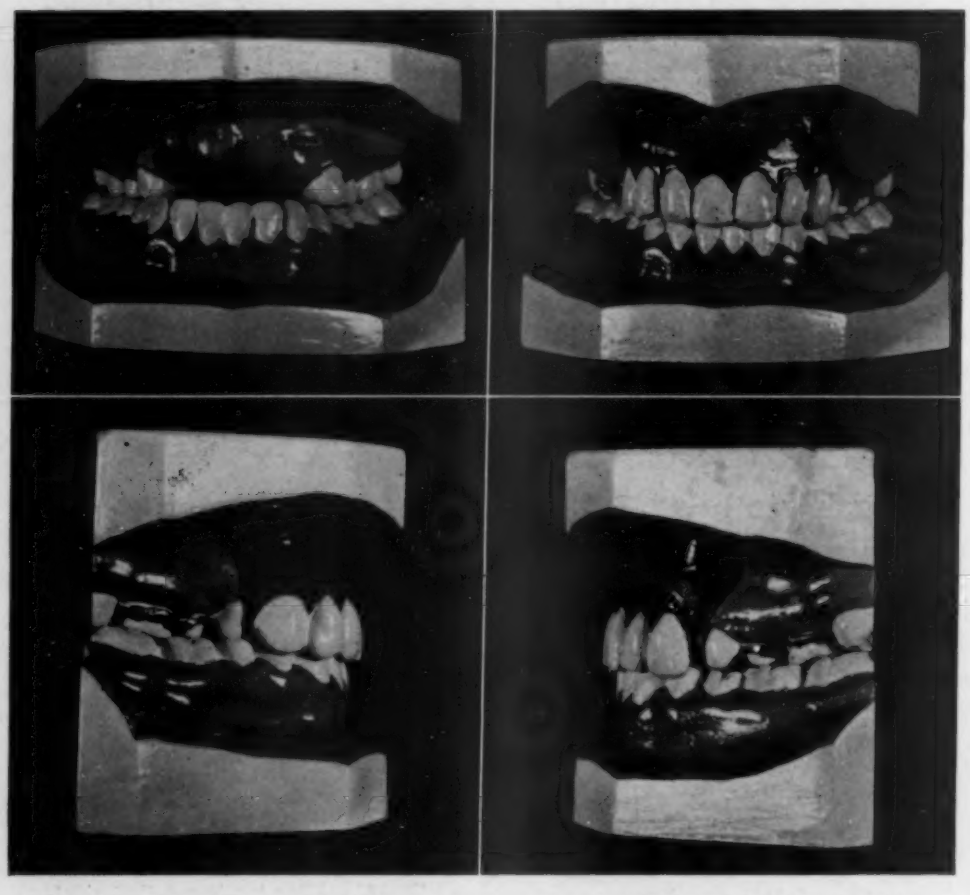


Fig. 15.—After treatment (right side).

Fig. 16.—After treatment (left side).

The actual work in each case is done by the senior students of the College of Dentistry, and each step is thoroughly supervised and checked by the supervisor of each department. From the time the patient first presents himself for

examination until the case is dismissed as completed, all departments involved work hand in hand. The cooperation of the several departments is splendid, and no one hesitates to seek the advice of others with respect to the patient's welfare.

Fig. 17.—After treatment.

Fig. 18.—After treatment.

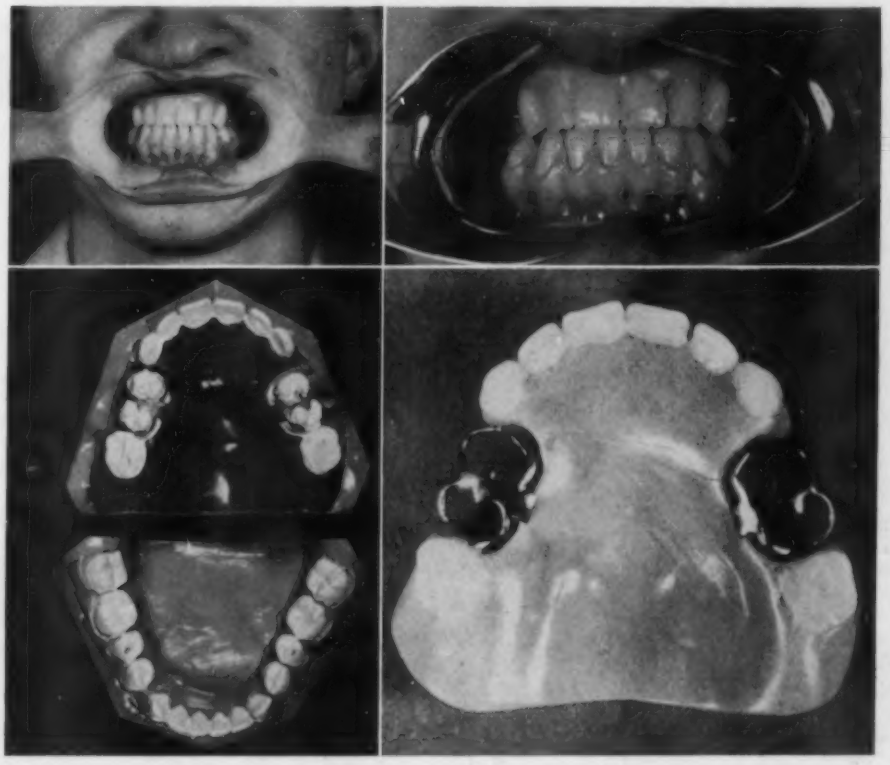


Fig. 19.—After treatment.

Fig. 20.—Replacement.

PROCEDURES OF ORTHODONTIC SERVICE

Since the program which includes orthodontic services is but eight years old, most of the patients referred for treatment are in most instances too young for orthodontic procedures. Cases which have been treated so far are, for the most part, cases which have been under Crippled Children's Service for some time, or have attained an age where orthodontics is indicated. Patients not yet old enough for orthodontic treatment are carried through diagnosis, and receive all surgical or operative procedures which are at the time indicated. Such patients are then dismissed and are placed on a call basis, to be returned each six months or twelve months for observation. If, during one of these return visits, they show a need of additional operative care or of surgery, such treatment is administered at that time. In this manner, the mouths of these children are kept in good condition and repair, since they have been taught the value of a clean, healthy mouth, and thus have a much higher appreciation of dentistry.

Fig. 21.—Before treatment.

Fig. 22.—After treatment.

Fig. 23.—Before treatment.

Fig. 24.—After treatment.

Fig. 25.—Before treatment.

Fig. 26.—Before treatment.

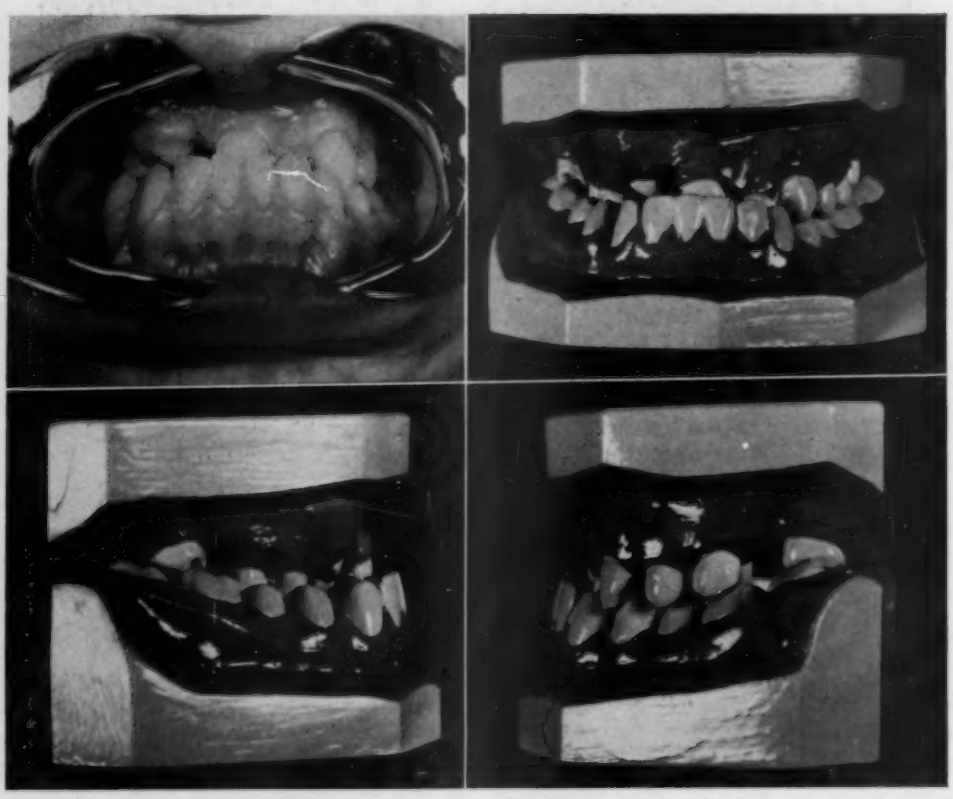


Fig. 27.—Before treatment (right side).

Fig. 28.—Before treatment (left side).

The real purpose of this orthodontic service is the rehabilitation of these patients in order that they may become more useful citizens and that they may more fully enjoy their existence. To make this service most effective, orthodontic and replacement procedures should be completed in the shortest possible time, keeping, of course, within the limitations of good dentistry and patient welfare.

Fig. 29.—Before treatment (occlusal). Fig. 30.—After treatment (occlusal).

Fig. 31.—After treatment. Fig. 32.—After treatment.

Most cases of cleft palate are mutilated cases, which means there are many misplaced or malformed teeth as the result of palate closure. Teeth in or adjacent to the cleft areas are considered poor risks for orthodontic treatment, both from the point of view of active treatment as well as from the point of view of retention. All badly misplaced or malformed teeth in or adjacent to the cleft areas are, therefore, to be condemned and removed surgically. Sound teeth in good repair are the only ones considered worthy of retention. We do not wish to infer that all badly malposed teeth are to be condemned. Only those teeth so badly malposed as to require long periods of orthodontic treatment in order to make them useful are condemned. We feel it is important to bring

about the orthodontic correction in the shortest possible time. Since every patient must wear some type of replacement, the addition of one or more teeth to the replacement will in most cases not prove an extra problem. Because of the surgical procedures involved in the closure of the palate and the absence of sound bone and tissue in the cleft areas, there are usually quite a number of questionable teeth. It is these teeth which we consider as poor orthodontic risks.

Fig. 33.—After treatment.

Fig. 34.—After treatment.

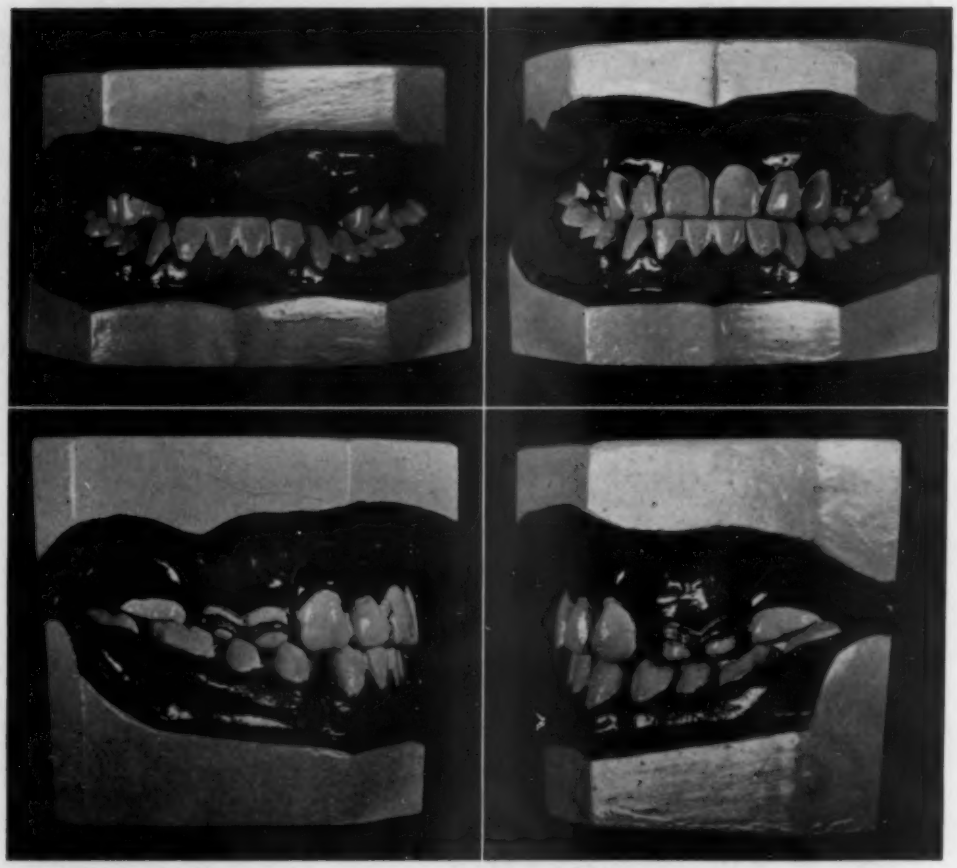


Fig. 35.—After treatment (right side).

Fig. 36.—After treatment (left side).

Usually, in the majority of cleft palate cases, we have found a nearly normal development of the mandible with little evidence of malocclusion. This, we feel, is due to the exercise and stimulation which the mandible receives. Because of the lack of complete function of the maxilla, the mandible is often put to compensating use. If some irregularity in the mandible does exist, this irregularity is considered for treatment if it appears that the correction can be made within the time for treatment allotted for the correction of the maxilla. Compromise treatment is considered in the more severe cases.

Following completion of the operative work and the surgical removal of condemned teeth, appliances are constructed which seem best suited for the individual case. Combination labial and lingual appliances with auxiliary

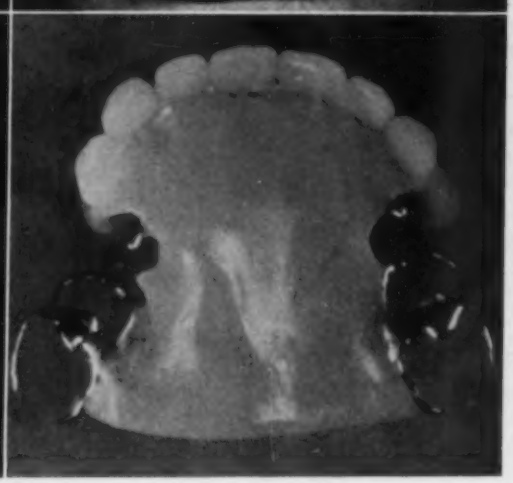
bands and attachments are most commonly used, since this is the technique taught in the orthodontics department. After the placement of the appliances, the patient is kept under observation for several days in order that it may be determined whether or not changes are necessary. The patient is then dismissed, and an appointment made for the next visit. Active treatment adjustments are usually made each four to six weeks. The frequency of the appointments depends largely upon the availability of the patient. Each time the patient returns for an adjustment, the appliances are removed; anchor bands are tested for cementation, and are recemented if loose; teeth are thoroughly cleaned and checked; appliances are cleaned; and the readjustment is made. Progress is noted by comparison with models made at the time that orthodontic

Fig. 37.—After treatment.

Fig. 38.—After treatment.

Fig. 39.—After treatment (occlusal).

Fig. 40.—Replacement.



treatment was started. Instructions are given to the patient regarding any changes in routine, and the next appointment is made. A period of retentive treatment is usually not indicated, since the replacement is so constructed as to include the features of a retaining appliance.

As soon as the orthodontic treatment is completed, the patient is turned over to the prosthetic department. Arrangements are made in advance for the patient to remain in the city at one of the convalescent homes during the time the replacement is being constructed. The replacement is usually one with a

cast gold framework and clasps, and is finished with one of the standard acrylics. The replacement is so designed as to be secure and well balanced, in order that it may give maximum functional security with the desired esthetic appearance. This type of replacement is best suited to maintain teeth in a position of good alignment, and is not easily displaced. If it is felt that some type of temporary replacement is needed, this may be an all-acrylic case with wire clasps. However, this type of replacement should not be worn for any length of time for the reason that, if there has been extensive tooth movement, there is likely to be some relapse, the relapse resulting from the fact that such a replacement is not as rigid or secure as is the cast gold framework. In patients who have been subjected to extensive surgery or poor palate repair, it may be necessary to rebase the case after a period of six months. Such a condition, of course, is no different than that which may exist in any case where there has been extensive resorption.

Upon completion of the orthodontic treatment and the construction of the replacement, record models and photographs are made of the case. The patient is given complete instructions with respect to the care of his teeth and is cautioned regarding the limitations of the replacement. He is advised that he will be expected to report each six months for checkup and observation. This contact with the patient is maintained until he is twenty-one years of age or has achieved a vocational adjustment.

Two case reports which have been selected as typical cases, with the included description and photographs, will perhaps furnish a descriptive explanation of the discussion presented above, as well as a concrete illustration of the service which has been rendered these patients.

CASE HISTORIES

CASE 1.—Mary Lou C., aged 16 years.

History.—Patient was admitted to the Dental Clinic in June, 1942, for rehabilitation. Her general oral condition was fair. The repair of the lip and palate was satisfactory. The lower arch was normal in development with lingual inclination of the teeth. The upper arch was badly collapsed with all teeth in linguoversion. Following routine examination and case planning, the operative work was completed. The upper right and left central incisors, cuspids, and unerupted teeth in the cleft area were condemned as unsuitable for orthodontics and were surgically removed. The upper right and left first and second premolars and molars were retained.

Orthodontic Treatment.—Anchor bands with buccal tubes and lingual stabilizers were constructed for the upper right and left first molars. A labial arch was adapted for expansion, and in June, 1942, this appliance was placed. The patient was then seen each six weeks for an adjustment. Later on, this labial arch was discarded, and a lingual appliance was constructed and placed to complete the expansion and individual tooth movement. Active treatment was continued until June, 1943, an elapsed treatment time of one year. The premolars and molars were moved to almost normal apposition with the lowers. In July, 1943, the replacement was constructed and placed, and the case was dismissed. The patient has been seen each six months for a checkup. (Figs. 1-20.)

CASE 2.—Leonard T., aged 17 years.

History.—Patient was admitted to the Dental Clinic in June, 1943. Routine procedures of diagnosis and operative care were followed. Lower arch development was satisfactory with teeth in good alignment. Upper arch development was quite good, and there was a satis-

factory repair of lip and palate. There were many displaced and malformed teeth both in and adjacent to the cleft area. The posterior teeth on both sides of the arch were also involved. After a careful study of the case, it was decided to condemn all teeth in the upper arch with the exception of the right and left premolars. The condemned teeth were all surgically removed in June, 1943.

Orthodontic Treatment.—The patient returned for orthodontic treatment in August, 1943. The left premolars were in a fairly normal position, but the right premolars were in linguoversion. Bands with buccal tubes were constructed for the premolars, and a labial arch adapted for expansion. The patient was seen each three weeks for adjustments. The active treatment period lasted three months. Following the period of active treatment, a fixed lingual appliance was placed for a short period of retention. The replacement was constructed and placed in November, 1943, and the patient was dismissed. There was an elapsed treatment time of five months, which is considered a good average. The patient has been seen in July, 1944, and January, 1945, for a checkup. (Figs. 21-40.)

ADDITIONAL FEATURES IN REHABILITATION

Additional features of the rehabilitation program should perhaps be mentioned at this point. The psychological reactions of the patient and the parent are a most interesting feature of any program of rehabilitation and should be included in this discussion.

A speech-training clinic, under the direction of Dr. Leroy Laase of the University of Nebraska, is available, in which many patients receive valuable training. A complete evaluation of the patient's intellectual, economic, and social capabilities is also made by people trained in such phases of social work. This evaluation includes mental tests, abilities in schoolwork, and problems of social adjustments. Patients found to possess certain abilities are urged to advance along lines for which these abilities fit them. Special training programs in various technical fields are available to these patients. These programs are under the direction of the State Vocational Agency, and through these programs many of the patients are thus equipped with some useful training which better enables them to take their place in society.

RESULTS OF THE REHABILITATION PROGRAM

Reaction of parents toward children with congenital defects is varied. Often the parent feels a sense of guilt in that the deformity may have resulted from some misdeed, which feeling often dwarfs the parent's sense of responsibility. The parent may completely reject the child and keep it in the background, or may do just the opposite and overindulge the child in an effort to make up the deficiency. There have been cases of child abandonment and parent separation because, in some cases, blame had been placed by one parent upon the other. When one of these unfortunate children is a member of a large family, neglect by the parents and by the other children in the family is usually more pronounced; it is children from such homes who are often most difficult to adjust. If the child is taken away from such surroundings until the rehabilitation program has been completed, this removal will often add to the possibilities of readjustment. We do not mean to suggest that conditions just described are universally true, for we do know that in many of these homes the parent's love for the crippled child is just as sincere as it is for the normal child.

The adjustment and change in attitude of the child following this rehabilitation program is most gratifying. Those interested in the program have enjoyed many moments of satisfaction and reward in seeing the startling change which takes place upon completion of the work. A child with a cleft palate realizes his defect, and is often backward or hesitant when placed with the normal child. Moreover, other children are prone to shun such playmates who are thus deformed. When the orthodontic correction has been made, however, the previously deformed child now realizes that he speaks more fluently and that his appearance has been enhanced. This attitude leads to an interest in his person, and it is not uncommon to see such an individual "blossom out," so to speak, into an attractive and self-reliant individual.

In the foregoing discussion, we have attempted to sketch the history of the Crippled Children's Service in Nebraska, to explain how orthodontic service has developed in connection with that agency, and to describe how it functions in cooperation with the College of Dentistry of the University of Nebraska. We have further attempted to show that by virtue of this orthodontic service unfortunate children have been rescued from the ranks of the crippled and deformed, and have been given a confidence in themselves which will help them to assume a more useful position in society.

To this end we dedicate this service in the interests of these individuals that they may become an asset to our nation instead of existing as a burden upon a community and being relegated to a life of despair.

The author wishes to acknowledge the help graciously accorded him by Mrs. Pauline Ryman, Medical Social Consultant for the Nebraska Crippled Children's Service, in furnishing data used in the preparation of this paper. He wishes, also, to give credit to those responsible for the administration of all the workngs of the program as well as to those who have been most helpful in furnishing the author with material for this thesis. He wishes especially to acqknowledge the assistance of Dr. E. W. Hancock, Chief of Services for Crippled Children, and also that so kindly given him by his colleagues on the staff of the College of Dentistry of the University of Nebraska: Dr. B. L. Hooper, Dean of the College of Dentistry; Dr. Fred Webster, Dental Adviser to the State Board of Control; Dr. Ralph Ireland, Chairman of the Department of Pedodontics; Dr. Donald A. Keys, Chairman of the Department of Operative Dentistry; Dr. Ferdinand Griess, Superintendent of the Department of Surgery; Dr. O. F. Cross, Acting Chairman of the Department of Prosthodontics; Dr. L. D. Arnot, Instructor in Oral Diagnosis and Treatment Planning, and of Radiography; and Dr. Lyle Furst, Assistant in the Department of Orthodontics.

The splendid cooperation given the author by each of these persons has contributed in a large measure to the success of this program, and each has contributed unselfishly of time and energy in the interests of these patients.

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OBSERVATIONS ON CERTAIN ASPECTS OF CURRENT ORTHODONTIC PRACTICE

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THE development and progress of orthodontics can best be measured and assayed at its operating point, namely, its clinical ministrations to society. Changes in clinical procedure are the result of new developments in fundamental principles of analysis and diagnosis of dental malocclusions and in the coordination therewith of mechanical methods of treatment. Today, the practice of orthodontics is being influenced from two sources, namely, a change in the basic philosophy of diagnosis and analysis and the segregation of treatment methods into groups. The past decade has been striking in both of these phases. Actively interested in our own personal problems of practice as most of us are, we are prone to disregard rumblings which may be heralds of great significance. But, here and there with increasing persistence, the cloistered calm in our individual office routine is gradually ruffled. We of the rank and file recognize that certain steps are being taken at variance with our present thinking, and we hastily begin to assay them in the light of our own individual philosophy and training. Orthodontists, being, as they are, men of strong conviction and proud of their specialty, it is natural that we find leftists and rightists always adequately represented on both sides of moot questions. This is certainly a healthy situation but, before we universally commit ourselves, it is always best to read the "minutes of the last previous meeting." With your permission, let's take a look at them.

All of us must admit that orthodontists have been disturbed during the past few years over the development of a philosophy of analysis and diagnosis of malocclusions which indicates the necessity for the extraction of teeth, notably, premolars. In some quarters, this sanctioning of a violation of heretofore established principles has been emphatically and bitterly opposed; in others, it has been hailed as the first rational solution of certain problems in orthodontics which have always plagued the clinician. The arguments pro and con over this question have been heated. Our literature gives evidence of this, but the published data anent the question do not adequately represent the turmoil which is evidenced individually and whenever two or more orthodontists meet in discussion of common problems. It has almost become a question of to which camp one belongs. He is either a radical or a conservative. Privately, every conscientious orthodontist has engaged in considerable analysis of his particular orthodontic results over the years, and his reflections have not always resulted in personal equanimity. I would like to make the point that anything which

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jars one out of complacency is healthful. It makes one think, if nothing else. But let's look back a little and examine the record before hailing this newer philosophy as a recent and revolutionary change in orthodontic thinking.

About forty years ago, in 1908 to be exact, Case published his well-known volume entitled *Facial Orthopedia*. Therein he sets forth his rationale of treatment in which the extraction of first premolar teeth was a routine measure. Since that time, the place of extraction of teeth in orthodontic treatment of certain malocclusions has received emphasis by many others. In attempting to crystallize my own sentiments relative to some of the limitations in orthodontic treatment, I read a paper before the American Society of Orthodontists in Toronto in 1932. I quote from it as follows: "The more I read of and observe clinically cases of malocclusion—the more I am convinced that actual disharmonies do exist between teeth and bony structures. Nor do I believe that the harmonization of the two tissues can always be accomplished by orthodontically placing, let us say, twenty-eight teeth into an occlusal relationship in agreement with our concept of the normal for mechanical balance. To hold to the contrary view would, in my estimation, arrogate to the mechanical relationship of the teeth a position of greater importance in the human economy than it deserves. When we are ready to state authoritatively that the orthodontic placement of the teeth into the mechanical arrangement demanded by an exact normal will overcome residual bony and muscular limitation of development, I will admit the error of my present position, but I do not think that time has yet arrived. Guided by our present knowledge I am willing to admit that compromises still have to be made, and this generally means the extraction of certain teeth, be they second or third molars, premolars or what not. May I here quote McCoy who says, 'To assume the attitude that extraction in orthodontic practice is never indicated is just as illogical as to indulge in it thoughtlessly and too frequently. It has a place, although the indications for its use are infrequent to the extent that it cannot be regarded as a regular routine measure.' The frequency of the occurrence of that 'place' in every orthodontist's practice as yet seems to be a matter of individual judgment, and while the act itself may not be considered a 'routine measure,' its potentiality as a sane factor in therapy should be so considered in the analysis of many cases of malocclusions." The foregoing was expressed fifteen years ago. During the same year Grieve came to some pertinent conclusions on the same subject in a paper entitled "Some Theories Obstructing the Progress of the Science of Orthodontia."

Thus, it is obvious that already many years ago thought was being directed along paths which have led to the development of a philosophy which is seeking to rationalize a basis for determining when and when not to extract teeth in orthodontic treatment. In our literature one finds much on this subject and indeed more is forthcoming. The activating force which has produced this train of thinking has been and still is a dissatisfaction with results of cases the treatment of which was predicated upon a previous philosophy. Is this attempt to improve orthodontic science a laudable enterprise, or should we be satisfied to rest our case on former standards and attribute our treatment failures to improper technique on the part of the operator? Personally, I subscribe to the

belief that all orthodontic thinking is laudable which attempts to bring about the three main objectives of orthodontic treatment, namely, the restoration of the affected parts to as nearly a normal efficiency as possible, the definite improvement of the face, and permanency of result. This type of thinking should be analyzed, broken down in its application to specific problems, and the results of the adoption of its principles in treatment carefully weighed and studied in the light of previous experiences. The question might then logically arise whether orthodontic treatment has been proved unable actually to accomplish what it once essayed to do, and hence a new basic objective well within the attainment scope of treatment had to be found, or whether our old concepts were really wrong. But it is becoming obvious that the extraction of teeth, singly, in pairs, and in fours, is assuming a prominent place in orthodontic treatment, and in the rationale of treatment in the practices of many conscientious orthodontists has a prominent place. It is also indubitably true that the validity of such compromise treatment, if we wish to term it such, has been amply demonstrated in the treatment results accomplished in certain types of malocclusions. What I am attempting to say is that it is always unwise to hail immediately each new development in the philosophy of the analysis and treatment of dental anomalies as being revolutionary and utterly antagonistic to previously accepted theory and practice. Rather, may we not consider recent development in basic points of diagnosis which make the extraction of teeth mandatory in treatment as being a recrudescence of thinking along lines which had its inception long ago. It is rather noteworthy that a philosophy which has long germinated slowly and always in an unfavorable atmosphere, has had the vigor to persist and demonstrate its present virility. It is true that all advanced thinking should be challenged but always in the spirit of ascertaining truth.

Along with a changing concept of the validity of former tenets of analysis and diagnosis in orthodontics have come developments in technical procedures. Here we have encountered aspects which are more tangible and far-reaching. It is not easy to reconcile the use of mechanical appliances which are adapted to bring about movements of teeth with some of our older concepts of anatomical structures.

Clinical orthodontics has been so shot through with empiricism, intolerance, and flag raising in many instances that it has been difficult at times to hold fast for any length of time to some certain life line of therapeutic philosophy. Many of us have observed the era of the D band and the E arch, the round and half-round pin and tube appliance, the ribbon arch and bracket attachment, the lingual arch, etc. Currently, we are dealing with the linguolabial technique, the open tube attachment, the twin arch mechanism, the universal appliance, and the edgewise mechanism. In addition, we may add that all of these mechanical systems of tooth movement have had added to them a multitude of "modifications." Some of these mechanical developments have enabled us to accomplish tooth movements of greater scope than are possible by the use of others. Perhaps all of them have limitations of one sort or another. Their efficiency in every instance is measured in terms of accomplishing what the operator conceives to be his prime objective. That prime objective seems to be the elusive *X* in the

orthodontic problem. To a younger man and student today, the reliability and authenticity of the objective he is seeking often seem to depend upon the method of mechanical treatment in which he has been tutored. It also holds true for older men who dogmatically have held fast to the use of the mechanical methods of their school days. This may or may not be a sound premise upon which to base one's own philosophy of treatment of malocclusions. Occasionally, a major malocclusion may present which, under analysis, might demand a certain direction of treatment. To one who is, let us say, an addict to one certain prescribed type of appliance, his basic analysis will be more or less influenced by the mechanical potentialities of his favorite appliance technique. He may thereby be handicapping himself severely. Failure in securing a satisfactory result under these circumstances gives rise to what we shall choose to call an "orthodontic alibi." Under this caption let us enumerate well-known slogans such as: (1) "lack of patient cooperation," (2) "failure of the tissues to respond to stimulation," (3) "limitations in bone growth potentiality," (4) "some systemic disorder or imbalance which limits the effectiveness of the appliance." Every one of us who has practiced orthodontics for a period of years has often longed to drape his failures to resolve effectively a malocclusion with the cloak of one or more of these alibis. It is still being done and doubtless will continue as long as we steadfastly place blind reliance upon some one so-called system of mechanics of universal application.

It is only fair to state that all of our present systems of organized mechanical techniques have certain definite qualifications but individually and collectively they are not perfect in universal application. In the realization of failure to bring about a satisfactory orthodontic result, why do we allow ourselves to resort to an alibi? It would be far better to examine ourselves in seeking the answer. To do this effectively demands, first of all, a freedom from the bondage of blind loyalty to but one type of technique as we are practicing it. In other words, we should always preserve an open mind. This is a lesson which, personally, I learned many years ago and which I am still trying to learn more effectively. Like many of you, I have sat at the feet of men whom I deeply respected and whose ability to treat malocclusions successfully was an inspiration to me. I, too, have returned to my practice, literally "cleaned house" and put into effect my new concepts of treatment. As time wore on, I discovered that I had not yet found the panacea for my orthodontic ills. At this point, one may arrive at one of two conclusions—either the technique upon which I had pinned my faith was fundamentally unsound, or I was incapable of utilizing it with the maximum efficiency of which it was capable in the hands of an adept operator, accustomed to its use. The first conclusion would obviously be unfair, for it had been proved effective in hands other than my own, which leaves me no alibi upon which to hang my failure other than my own ineptness.

This blind acceptance of the reliability of an appliance to accomplish the satisfactory resolution of any case of dental malocclusion can be strikingly illustrated time and again. It has been going on for years. It is as true of the older types of mechanical devices as it is of the newer types, and most of us have had opportunity to observe the results of such thinking during the past few years.

During the war years, there have been many more of what we may describe as "itinerant" orthodontic patients. We have all been confronted with them. Thus, we have been provided with the opportunity of observing how "the other fellow" works. Through this means there has been revealed much excellent orthodontic treatment, and an equal amount indifferent and even decidedly bad from the standpoint of both analysis and treatment. Your patients have had to be referred elsewhere for continuation of treatment and so have mine. I must confess that in such instances I have always had a feeling of trepidation, of apprehension that my concepts of analysis and treatment might not coincide with those of the operator under whose care the patient would fall. In this day of the apparent segregation of orthodontic operators into groups devoted to the use of any one of several rather well-defined types of mechanical appliances, this is a well-founded apprehension. In that connection, I shall never forget one instance in which a patient had been referred to an orthodontist in a distant city. Upon presentation of the child to the new orthodontist, the mother was told emphatically that the appliances already in place were not fit to be placed "in the mouth of a dog"! Perhaps they weren't, but maybe our Minnesota dogs are of a different species than those in that sun-kissed state! In another instance of referral of a patient under treatment, I was informed by the orthodontist to whom referral had been made as follows: "Thank you for the reference of Miss Blank and for the receipt of all data concerning her case. I would like to tell you that when it comes to the manipulation of any appliance except the 'so and so,' I am unfortunately all thumbs. I am wondering if you have any objections to my discussing this matter with the parents of the child." Since I had no objections, he concluded the treatment of my patient in a beautiful manner, better, I believe, than I would have done. Right there I discovered that this operator had something which I lacked, and after seriously studying some of his treatment procedure, I abolished one of my own alibis.

Orthodontists must learn that "ideas won't work unless you do." The reason that certain outstanding men have achieved stature in orthodontics is not because they have had ideas. It is because they have worked for the solution of their problems and have been dissatisfied with other teachings and methods. The same work habits should be practiced by all of us. To be unwilling even to investigate and study changes from a previous routine of thinking and action and merely universally condemn them is, to say the least, an ostrichlike attitude to assume. It is, however, equally foolhardy to leap in, grasp, and accept each new course of action in its entirety and simultaneously decry and deprecate all other contemporary orthodontic thinking.

I am thoroughly of the opinion that the hasty espousal of the theories and techniques of thoughtful leaders by men illy equipped in experience and fundamental training is capable of minimizing the real value of the teaching they have received and, in many instances, is productive of actual damage. One such instance was vividly revealed only recently. This little itinerant patient presented to the office of one of my friends for continuation of treatment after having worn appliances for about eight months. All teeth had been banded and the maxillary dental arch had been expanded to the point where every tooth was

in buccal occlusion to the mandibular dental arch! From an original malocclusion which might be succinctly classified as an Angle Class II, Division 2, condition, this mouth had been converted into a grotesque deformity. The banding technique, per se, may have been excellent, but it was hideously apparent that the appliance potentiality and its efficacy when properly utilized were a closed book to the operator. One cannot unqualifiedly condemn the entire philosophy of diagnosis and analysis which gave rise to the development of the type of appliance which had been used in this instance. But what one can learn from such an example is that without a fundamental knowledge of the basic philosophy of diagnosis, analysis, and treatment planning, no amount of technical skill will suffice for the correction of any malocclusion.

The itinerant orthodontic patient has also revealed that much orthodontic treatment is still of the "two-by-four" variety, namely two arches and four bands. This I have learned from many sources and not entirely from my own observation. We of the older generation, perhaps, have been chiefly culpable on this score. It is hard to teach an old dog new tricks, but it is downright difficult to teach a lazy, old dog new tricks! It is not impossible, however. A professional man can never coast along on his previous success, and it is pertinent to remark that one can coast in only one direction and that is downhill! To men who have grown old in the use of a single method of treatment, a referred patient wearing appliances of a different nature presents a disturbing problem. There have been many such instances in recent years. If the patient is to remain under the second operator's care for a considerable period of time, he should be justified in suggesting appliance changes in harmony with his own ideas and ability to manage. If, on the other hand, such a referred case is to be under his care for only a short time before returning to the previous operator, it is his obligation to see that treatment time is not lost and that real progress is achieved. This can usually be done successfully, even though the appliance in position is not one of his choice, provided that the previous operator had a definite philosophy of treatment well under way with an appliance adequate for carrying out his plan. It is never possible, however, when no direction of treatment is apparent and the appliances are merely residual upon the teeth and possess none of the requirements demanded of an active mechanism. It is obviously unfair to expect every orthodontist to be a master of every type of technique, but he surely should not have allowed himself to become so apathetic to orthodontic development that any change from his daily routine is viewed with a complete lack of understanding. Nor is he justified in condemning it on those grounds. It is even possible that if he preserves an open mind he might learn something to his advantage. Yes, the war years with their increase in the number of itinerant, referred cases under treatment have given many of us the opportunity to learn much. The experiences of many men indicate that orthodontic treatment throughout the country ranges from instances of meticulous analysis, treatment planning, and appliance construction to other instances where actual treatment rendered has been largely vocal. How the orthodontist to whom such cases have been referred shall act under these various circumstances is a matter of his own conscience, honesty, intelligence, and awareness of the reactions of the public.

As is the case in other professions, orthodontics finds within its ranks practitioners whose expressed beliefs in the fundamentals of the specialty do not coincide with their expression of them in the technical application of treatment. It is necessary to do more than pay lip service to philosophies of diagnosis and analysis and the demonstrable effective mechanical methods of accomplishing an objective. Perhaps the opportunity of being able to draw such a conclusion is not granted to many of us. However, the validity of the statement would become apparent if one were able repeatedly to view clinical procedures and results of treatment from sources which represented a cross section of orthodontics as practiced in this country. Poorly executed application of theory causes orthodontics to fail at its vital operating point, namely, the rendition of a satisfactory service to the public. Those who call themselves specialists in the field have a definite responsibility here and it should not be taken lightly. The entire matter of the public relations of a profession is vitally affected by the reactions of every patient who enters our offices. In order to enlist the aid of every patient to further the development of the public relations of orthodontics, that patient must have received a service which is truly representative of the science's value to the public. Thus, the development of public good will and confidence lies fundamentally with each individual operator, and he should consider it his debt to the public. One sometimes wonders if we give enough consideration to this point or give it its proper value when we consider how conspicuous orthodontic services are and how potential either to make or mar. One can often become so serious about and so close to immediate problems that he may lose sight of a greater significance. The value of orthodontic services in a community may be seriously impaired by the rendition of inadequate services on the part of only one or several operators whose concepts of practice management and public relations are not of the proper standard. This is a point of which we should constantly be aware. Recognition of this responsibility cannot fail to result in rather serious self-appraisal and the measurement of our own individual accomplishments with a yardstick which represents a standard based upon correct principles.

It is also apparent to one who has had the opportunity for such observation that there is a constantly increasing number of younger men in our profession who are demonstrating a zeal and devotion to orthodontics which augurs well for the advancement of the profession. I frankly believe that many among this oncoming generation of practicing orthodontists will contribute greatly to orthodontics' stature in the coming years. They are men who are bound to no apron strings. They will adopt any technical change which proves itself valuable, and will drop it as readily when it is supplanted by another of greater advantage. These are the men who really believe that in the final analysis the public is justified in believing that after all is said and done, children go to an orthodontist to have a facial deformity, malocclusion, dental anomaly, or call it what you will, corrected. These are the men who haven't allowed themselves to get so close to their problem or so serious about it that they are unwilling to search for and listen to another man's solution of the same problem. They do not use a twin wire appliance, an open tube appliance, an edgewise, or a universal mechanism

because Johnson, McCoy, Tweed, or Atkinson does, but because *they* find *they* can render better services by using certain methods of practice. These are men who are never satisfied, who are constantly seeking better ways to accomplish better results, and whose loyalties are only to the profession and the public it serves. There are many such in orthodontics today.

To be privileged to sit on an examining board such as the American Board of Orthodontics for a number of years provides an excellent opportunity to observe the clinical procedures and fundamental thinking of a large cross section of orthodontic practitioners. The nature of the examinations is such that these two points are brought out by the material submitted. It is true that every applicant puts his best foot foremost when presenting required material but, even so, the end product is generally revelatory. As from observations in private clinical practice, but on a larger scale, much individual weakness and strength are revealed. Glaring discrepancies often occur between a candidate's apparently sound grasp of biologic principles and his application of them in the treatment of given cases. The converse is likewise often strikingly revealed. When a balance between the two occurs, one usually finds an orthodontist who has a keen sense of his responsibility to the public, his profession, and to himself. There are many of this kind who have been eager to place their credentials before an examining board and whose qualifications the board has had the privilege of viewing. The increasing number of such men who are being certified each year augurs well for the advancement of our specialty. But there also exist among us many entrepreneurs whose desire to be certificated might easily be construed to spring from a sense of fitness which is not corroborated by the evidence which they submit.

As I have stated, the American Board of Orthodontics has had a rather unique opportunity for observing variations in clinical practice during the past few years. It might not be amiss to state that the results which have been demonstrated from the use of the various so-called systems of technique have produced some excellent results in treatment. Similar objectives have been reached although through different technical means. There have, of course, been variations in the concept of diagnosis and treatment planning. In many instances, it is clear that definite case planning has been entered into by the orthodontist, which, in itself, is a good indication of the thoughtfulness of the operator. However, it has also been observed that there are still a great number of men whose concept of treatment was not fulfilled by the technical means they have employed and, as I have mentioned before, such occasions are evident among men who have not had the opportunity for or taken advantage of training which has been available during the last ten years.

It has also been noticeable that in the presentation of case reports, written theses, and technical presentations, better records seem to be maintained by our younger generation of orthodontists. The Board feels that perhaps it has been a healthy influence in this direction by demanding from applicants for examination that the material which they submit must adhere to a well-integrated plan. On some occasions, candidates have been unable to submit material at a given time because of their failure to have maintained adequate records, and additional

time has had to be allotted to them so that their material could be properly correlated. By demanding a certain standard of presentation, the Board feels that the applicant, in conforming to its rules, is provided with a means of comparing his own standards of record keeping with those of the Board. By this means, he can ascertain what his shortcomings in practice management and treatment may have been. If he is of the right caliber, this will result in better service to his patients. The foregoing may be summed up by stating that when it comes to case planning and treatment, a well-thought-out course of action is infinitely better than no plan at all. Hit-and-miss methods are still with us in large measure, but a philosophy of trial and error in the treatment of cases should be outmoded by this time. There are still a large number of orthodontists who are following no set principles of theory and practice, and, while definite and satisfactory results of treatment have been demonstrated in given cases, one might be forgiven for wondering whether a high level of service can be consistently maintained under such circumstances. This number will steadily decrease, however, with the entrance into the field of men whose orthodontic education has been of a higher order.

That the practice of orthodontics is emerging from its rather insular aspects has also become evident. It is rapidly entering the field of health service. This is becoming more and more apparent each year, and the value of certification by our own specialty Board becomes apparent when these new relationships are considered. This places a large responsibility on a certifying board and it demands scrupulous attention to qualification of candidates who shall represent the profession in its more public aspects.

While we are on the subject of the Board, which after all was created by your and my organization, I would like to say that your American Board of Orthodontics does not consider itself a jury which has the right to pass upon the validity of conflicting biologic and physiologic theories. This is not its province, but it is vitally concerned with how every applicant for certification is delivering his services to the public and representing his profession. This is its prime concern and in that respect it has to be larger than individual intolerance of another's point of view. The ethics in the practice of a profession are universal in their application. I mention this fact here in the bosom of my own Sectional Society for the reason that the Board has occasionally been criticized because it is unwilling to judge the ability of a candidate with but a single yardstick. This it should not do lest it lose its value as an accrediting Board. The right and wrong of biologic and physiologic principles and techniques are established elsewhere, in our educational institutions and through research, and until the Utopia of an exact science has finally been reached, no arbitrary position can be occupied by your Board.

Current orthodontic practice today embodies philosophies and techniques of which it was incapable in the years when apparently but one Messiah and one Bible guided its destinies. Perhaps one could administer a practice then with greater complacency and self-satisfaction, attributing failures to causes beyond one's control and crediting successes to the infallibility of a technique. But, even in those days, some of us remember men who were skeptical of the poten-

tialities of orthodontic service and the more or less extravagant claims that were made as to its value as a health service. In one or two instances, men even abandoned the practice of orthodontics for those reasons. Today, one still hears rumblings questioning the efficacy of orthodontic treatment, but the majority of such claims have no real basis in fact. Many of the knotty problems which confronted an older generation of orthodontists are finding their solution.

The field of orthodontics will always be under close surveillance by the public and its sister professions, for it is a conspicuous service. It is not easy for orthodontists to bury their mistakes. This makes it all the more necessary that orthodontists consider the specialty in a very thoughtful frame of mind and bear in mind the implications of its many facets. I know of no other profession which offers a type of professional reward comparable to orthodontics. At the same time, it is one of the most exacting professions if we are to represent it adequately.

In concluding this short paper, I would like to re-emphasize the necessity on the part of individual orthodontists above all to scrutinize their own ability and to be aware of the entire fabric of the responsibility of orthodontics as a public service. Proper diagnosis and analysis and an adequate technique to bring about desired results are the requisites of the best orthodontic service. Based upon fallacious original concepts and faulty technique, an apparently successful culmination of orthodontic treatment today may prove to be a failure tomorrow. This is the constant skeleton in the closet of every orthodontist. Sometimes these skeletons remain hidden or, at best, the closet is poorly illuminated and they reveal themselves only dimly. It is when the door is rudely opened and the powerful light of new knowledge pours in on them that they really are displayed. Every orthodontist would do well to equip himself today with the means to illumine his own closet and help to drag out all of the skeletons from all of the closets of orthodontics. It can be done only by individual hard work, study, analysis, and the arrival at unbiased conclusions which ultimately will be reflected in one's daily work.

Medical Arts Building.

ORTHODONTIC EDUCATION

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THE problem of adequate education necessary for the practice of orthodontics has been a subject debated and discussed for many years, and at the present time the entire question is in confusion.

The preparation of men for the practice of orthodontics has, to a large extent, been in short-term courses outside of recognized dental educational institutions. This has led to a muddled situation, placing undue emphasis on appliance construction and the mechanical application of appliances rather than on the basic principles underlying the successful therapeutic utilization of appliances based on the physical evaluation of the patient.

The history of orthodontic education is interesting. Dr. Angle, before starting his course outside of dental schools, approached both Northwestern University and the University of Pennsylvania (Noyes in Koch's *History of Dental Surgery*) with the thought of incorporating a complete course in orthodontics in these institutions, but, at that time, it was looked upon as too idealistic to be incorporated in the then existing dental curricula so, in 1899, he started a three weeks' course. This was followed by the formation of the Angle School. In subsequent courses, the time was increased to six and later to eight weeks.

Credit must be given Dr. Angle for his recognition of the need for basic knowledge as essential to orthodontic education, for we find in his later courses (1908, etc.) lectures on anatomy, comparative anatomy, embryology, histology, anthropology, art, and photography.

Following the Angle pattern came the Dewey and International schools. It is not the purpose of this article to condemn or to minimize the value of these courses because, for at the times they were presented, they gave an excellent understanding of the specialty. The criticism rather falls on our university schools for not adding graduate studies as part of their training. The lack of properly established courses of instruction on the graduate level has allowed schools of proprietary ownership of lesser standards to exist. Many of these courses are popular because of the short time involved and the promises given to students. They have large enrollments and, by having the sanction of the states in which they exist, are, to some extent, recognized. Unfortunately, the graduate level of orthodontic instruction is of recent origin (Columbia, etc.), and these universities are still compelled to compete with the short-term, inadequate courses.

The problem of orthodontic education must be considered under three

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divisions: the undergraduate level, the graduate level of teaching, and the short-term refresher type of course.

Orthodontics was first taught and for many years continued to be taught to undergraduates in the department of mechanical dentistry. Later, a separate orthodontic department evolved. Whether because of its start in mechanical dentistry or because of its lack of recognition as an integral part of undergraduate instruction, the fact is that there is less standardization of orthodontic teaching than of the teaching in any other department of dentistry. The teaching in the courses depends, in large part, upon the head of the department. They range all the way from schools in which a *complete* course in laboratory technique is given to those in which little or no appliance teaching is given; from schools in which orthodontic cases are assigned to students for treatment to those in which a small clinic is maintained and the work is done by instructors on cases used to illustrate possibilities in orthodontic treatment.

In most dental schools, the orthodontic department is looked upon as a necessary evil—something which must appear in the catalogues. Appropriations are as small as possible. Most state boards do not examine in orthodontics; some ask no questions for licensure; some, one or two in the questions on prosthetic dentistry. This has led the universities to feel that development of the orthodontic department was not necessary.

The situation has not improved in the last twenty years as it has in other teaching departments. In honesty we must admit that in the undergraduate school orthodontics does not amount to much. Yet, the licensing of a dentist in nearly all states permits him to practice orthodontics on the unfortunately trusting public. The dentist, by reason of his inadequate education, is a gullible victim of commercial laboratories. We are amazed by the number of cases for which treatment is planned by the salesman in the dental depot and by laboratory technicians whose sole interest is in the sale made. Aren't we of the American Association of Orthodontists responsible for this situation?

The problem is helped very little by the dental educators. Miner and O'Rourke in their book, *Dental Education*, give us very little help. In most of our undergraduate courses, the orthodontic teaching is not proper training nor do I think that anyone teaching orthodontics in any undergraduate school would consider the student, upon graduation, capable of undertaking orthodontic treatment.

In considering the undergraduate problem, we realize that it is possible to develop the undergraduate student to the same level of knowledge, upon graduation in orthodontics, as is achieved in prosthetics or operative dentistry. However, to do this would require the same or even longer hours than are now spent on these major subjects. The practicability of this is questionable as orthodontics, presumably, if practiced by the general practitioner, would account for only about 5 per cent of his practice, whereas prosthetics and operative dentistry make up 90 per cent of general practice. Therefore, to divert time from these majors is not good practice. Rather, the student in

the undergraduate school should be thoroughly grounded in the growth and development of children, the evolution of occlusion, the time to advise treatment, and a generalized understanding of the possibilities of orthodontic treatment so that he can properly advise and direct the orthodontic problems in his practice, leaving the actual treatment and diagnosis to one of graduate training. If the undergraduate, upon graduation, is interested in orthodontics, he should take additional training with the intention of practicing it as part of his general practice or as a specialty.

This leads to the next problem. If we are to advance orthodontics, it must be accomplished through graduate training in orthodontics.

The writer has been assigned the task of formulating a course in orthodontics on the graduate, university level. The objects of such a course, as he sees it, are:

1. To maintain and develop dentistry's proper place as an integral part of graduate education and of orthodontics, a specialty, to the same extent as any other medical specialty.

2. To balance equally instruction in basic sciences and clinical practice with teachers as well prepared as those in other graduate courses in medicine, namely, orthopedics, internal medicine, general surgery, otolaryngology, pediatrics, all of which have been established for many years.

3. To offer a year's course, leading to a certificate, consisting largely of teaching of the basic sciences with clinical practice based upon these sciences.

It is possible through further periods of work to earn a master's degree and a doctor's degree through original research.

Let us evaluate the present practice of orthodontics and then consider the future. About 1 per cent of the dentists in the United States are specializing in orthodontics, mostly in the urban centers, which are able to fulfill the needs of the cities. There are many cities of from 100,000 to 500,000 drawing population without a properly trained orthodontist. The greatest opportunities lie in such cities.

A novice trying to evaluate the present procedures in orthodontics would be extremely confused and upset by the literature. There are those who extract and who are very vocal in their contentions that it is impossible successfully to treat without extraction. There are those who do not extract and who consider it unnecessary and malpractice to do so. In therapy, there is the school of fixed appliances with bands on most of the teeth, the teeth being completely subject to the appliance. There is the school of light pressure, intermittent treatment with rest periods, and little or no retention. This situation makes educational planning very difficult. All schools of thought have their exponents and none can see any good in the others. This leads one to believe that this confusion of thought is due entirely to lack of basic scientific education in the fundamental principles underlying our specialty. Assuming this to be true, what should we teach and what should we expect from such studies?

The foundation of medical science is anatomy, both gross and microscopic, with the emphasis on development of head and neck with particular

attention to the evolvement (embryology) of face, jaws, teeth, occlusion, and temporomandibular joint, the muscles of the face and their relation to masticatory movements and the teeth, anthropology, physiology of the human face and dentition, racial characteristics of occlusion, evaluation of measurements of the face and dentition, and the use of anthropologic measurements of individuals in practice.

This leads us into physiology and, upon a basis of general physiologic principles, the specific action and reaction of muscles, their relation to bone and speech, study proceeds. There is, of necessity, much work to be done on the physiology of the oral cavity. We speak a great deal in orthodontics of the physiologic basis of tooth movement, but know relatively little about it. It would seem from the literature that the physiologic limits of tooth movement are not based upon any scientific evidence or research but rather upon the limitations of the operator in accomplishing the desired result. The point at which physiology stops and pathology begins is an academic question, but the harm done by orthodontic appliances must be studied and investigated. Histology and pathology must make clear to the practitioner the tissues involved and the bone and tissue changes incident to tooth movement.

All of us realize from the work of scientific investigators that much harm can result from the improper application of force to teeth. What are the limitations in the child? Pediatrics can help us. I think that a qualified pediatrician should be a member of the staff of every orthodontic clinic. He should be trained not so much in diseases of children as in their growth and development. He should be thoroughly versed in endocrinology so that he can work with the orthodontist in the solution of the physical approach to our problems. The future of orthodontic practice must be based upon a better evaluation of the children who are presented to us for treatment.

The study of appliances should be made from the standpoint of mechanical efficiency. A course in the mechanical principles involved would be of assistance in the development of new appliance forms. A student properly grounded in the basic sciences would make more rational use of these mechanical principles in handling his appliances.

The history of orthodontics is an interesting one. In reviewing the literature, it is interesting to note how many articles presented today are only a revival of principles and practices advocated long ago, many of which have been discarded for good reasons. It is necessary in graduate teaching to stress history on a horizontal level in order to show the science evolved. A review of the past literature would certainly eliminate many errors commonly practiced today. Oral surgery must be understood in the phase which treats of exposing unerupted teeth in order that the orthodontist may bring them down and into position.

The study of child psychology is very important so that we may deal wisely with our patients. A student should have a course in advanced dental radiology. It seems unnecessary to discuss laboratory technique. Naturally, it is important that all usual forms be constructed and studied from the standpoint of mechanical principles and physiologic effect.

The relation of the undergraduate to the graduate school is of interest. As nearly as possible, they should be separated. Experience has shown that it is difficult to conduct undergraduate and graduate levels of instruction simultaneously. Short-term, continuation, or refresher courses are an integral part of an educational program. Courses of this type, in orthodontics, should be offered only to men of adequate experience in the practice of the specialty. They cannot be devised for men in general practice who have insufficient experience. Courses of this type must, of necessity, be largely technical in character, and a basic, fundamental understanding is impossible in the length of time at their disposal. This type of course is desirable in that it can raise the level of practice by giving many men practicing orthodontics the basic education which they had not previously obtained.

The relation of orthodontics to the other specialties and divisions of dentistry enters into a discussion of education. A close association with pediatrics and an intelligent approach to children's dentistry are impossible without at least an academic understanding of orthodontics. Again, this is our responsibility. Periodontia and prosthetics can be aided by a correlation of their problems with those of orthodontics. How is confusion to be changed into an orderly procedure?

1. Laws governing the practice of the specialty such as now exist in Oklahoma, North Dakota, and some other states must be passed generally. Orthodontics is suffering because men of little or no training set themselves up as specialists and practice on the unprotected public.

2. Orthodontists must seriously consider and arrive at definite conclusions as to the quantity and type of orthodontic instruction to be given in undergraduate schools.

3. Graduate courses in orthodontics must be established in more of the universities so that the curse of short-term, inadequate courses may be curbed.

Orthodontics is a needed health service and the public must be served. Unless the standards of orthodontic practice are raised, the public will continue to suffer.

The American Board of Orthodontics plays an important part in the future of orthodontic education. At present, its function is largely that of determining the fitness of the applicant for certification. Determination of fitness is based largely upon treatment evidence. The Board, by recommending courses of study to educational institutions of university level and by working with these institutions, can help to eliminate the dangerous, short-term proprietary schools. It might be advisable to include examinations of the applicant's knowledge of the basic sciences for the fulfillment of qualifications for his certification. This is now the practice of many of the specialty certification boards. Establishment of the specialty of orthodontics on the high level which good orthodontic service merits cannot be achieved unless responsible members of this profession work unceasingly to improve the caliber of orthodontic education.

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ORTHODONTICS—A VITAL PHASE OF DENTISTRY

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THIS paper is not written to give you an account of orthodontic techniques, but it is with the desire to bring about a better understanding of our mutual problem, the health of our children. It is very necessary in the days to come that America remain the strongest nation on earth. To do this, we must see that our children have every advantage in maintaining their health. We dentists play an important part in this program, because, as we all know, children with crippled and defective mouths cannot grow to be healthy men and women. It has been mentioned in the literature time and time again how important it is to maintain a healthy mouth. Our opportunities to help keep America strong and healthy are tremendous. In order to accomplish the utmost, the men in general practice and the men who specialize in orthodontics must have a sympathetic and an intelligent understanding of each other's problems. I have been attending dental meetings for the past sixteen years and have never in all this time heard an orthodontist present a paper or even discuss an orthodontic problem. We are all a part of dentistry, and, certainly, the orthodontist is dependent on the dentist for his whole existence. And we orthodontists hope that we can be helpful to you in assisting in solving some of your problems. We are all working toward a common goal, namely, establishing and maintaining the best possible dental health in our respective communities.

What is orthodontics? Hoffman,[1] in 1933, gave a very complete definition. He said, "It is a bio-mechanical science which has for its object the prevention or correction of malocclusion of the teeth, and the harmonizing of the structures involved so that the dental mechanism produced will be best suited to the functional activities of the human organism as a whole. In theory or in practice, it is the study of growth and development linked with physical and mechanical principles." I bring you this to point out that the orthodontist's work is not solely mechanical, and that he is not just a wire bender as he is so often referred to. The practice of orthodontics is associated closely with growth and development, and the successful orthodontist is cognizant of this. It has been proved that growth is not a continuous process. Children grow in spurts, and may have periods of months, or even years, when little growth is apparent. Another interesting point I would like to clarify while we are on the subject of growth is the fact that there is no relationship between the teeth and the size of the jaws. We have all seen cases where individuals were missing as many as ten to fifteen permanent teeth, yet their jaws seemed to develop to normal size, both in width and length. The phenomenon of growth is very complicated and presents many intricate problems. The orthodontist must take into full con-

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sideration all factors which may be retarding a child's growth before he institutes any mechanical therapy.

Next, what are the causes of malocclusion? Probably every one of you memorized them in dental school, but, in order to progress with our thought, I think it would be well to review briefly some of the more common causes. Etiological factors of malocclusion may be divided into two groups based upon: (1) the time the factor occurs and (2) the manner of occurrence. The first in turn may be listed as inherited, congenital, and acquired. The second may be divided into oral, local, and general. Oral causes have been called determining or direct, and general causes have been called constitutional, predisposing, remote, or obscure. Under congenital causes we would have harelip, cleft palate, supernumerary teeth, missing teeth, abnormal frenum labiorum, and enlarged tongue. Under acquired causes, we would list early loss of deciduous teeth, tardy eruption of permanent teeth, early loss of permanent teeth, improper restorations, loss of mesiodistal diameter of the teeth, prolonged retention of deciduous teeth, disorderly eruption of permanent teeth, transposed teeth, malformed teeth, nests of miniature teeth, cysts, deflected canines, accidents, mouth breathing, enlarged tonsils and adenoids, faulty development of the child which is often associated with an endocrine gland disturbance, especially pituitary and thyroid, and habits (such as finger- and thumb-sucking, lip-biting, tongue pressure, sleeping habits, and resting face on hand). These are the chief causes of malocclusion, and I think it behooves every practicing dentist to keep them in mind when examining children's mouths. I suggest that you do not confine your examination to the open mouth, but that you have your patient bring his teeth into occlusion, so as to evaluate correctly any abnormality that may exist in the relationship of the dental arches. So often if these abnormalities are detected early malocclusion can be prevented.

I suspect that the question you are asked most often by parents whose children are in need of orthodontic treatment is, "When should orthodontic treatment be started?" This is a subject that even orthodontists themselves do not agree on. Some advocate early treatment and others believe in late treatment, late treatment meaning after an individual has all his permanent teeth. I will attempt to answer this question for you with ideas which I consider reasonable and sound. When to start treatment is a question which cannot be determined by the chronological age of the patient. We must remember that we are dealing with an ever-growing, ever-changing individual. Therefore, every caution and care must be taken in placing any appliance which might interfere with the growth processes. We must also bear in mind that, at the present time, there is no way to predetermine the size, shape, length, or width of the adult denture in the mouth of a growing child. It is just as foolish to attempt to predetermine the size of the adult denture as it is to take a child's hand and tell his mother that when he is grown his hand will be of certain dimensions. It is absurd to put orthodontic appliances on a young, growing child and to attempt to reshape the denture into a pattern of our own choosing. "The fact must be realized that any artificial impulse or mechanical stimulation is finally subservient to certain limits of growth of the individual."[2] Another

point I would like to bring to your attention is that many cases appearing to be in malocclusion at an early age prove to be only stages in development, and actually would develop into good functional dentures without any orthodontic treatment. As an example, a great many children up to the age of 6 or 7 have an overbite, which is more pronounced than would be desired in the permanent denture. In many instances this is normal at that age, and as the child attains vertical growth of the face this overbite will often correct itself.

It is my opinion that there is little change made in the permanent alveolus by treating the deciduous teeth. Mershon[3] stated, "The alveolus of the deciduous teeth develops as they develop, and resorbs at the same rate that the roots of the deciduous teeth resorb. As the permanent teeth begin to form, their own alveolus supports them. Its development is synchronized with that of the teeth. This being true, how can we hope to influence the positions of the permanent teeth by treatment of the deciduous teeth?"

There are some few cases, however, which should be started at an early age, and, if these cases are left untreated until all permanent teeth erupt, a great deal of harm will have been done which could have been averted. In cases of extreme protrusion of the maxillary anterior teeth, where the lower lip is habitually held between the lingual surface of the maxillary teeth and the labial surface of the mandibular teeth, treatment should be instigated early. The majority of these cases, if left untreated, will get progressively worse. By correcting this protrusion early, so that the child is able to close his lips normally, a valuable service has been rendered, and quite often the child will not need any further treatment later in life. The deformity presented in this type of case is very disfiguring, and may lead to the development of unfortunate personality traits. When the maxillary teeth bite lingually to the mandibular teeth, treatment should be started early. If the maxillary anterior teeth are allowed to develop lingually to the mandibular anteriors, they become locked to such an extent that normal development is interfered with. These teeth should, therefore, be brought into normal position as early as the deformity is recognized. When the buccal cusps of the maxillary six-year molars as they erupt bite into the central groove of the mandibular six-year molars on one or both sides (a condition commonly called "cross-bite"), treatment to correct this condition should be started at once. This treatment takes only a short time, and the appliances may be removed with little fear of collapse.

Orthodontic treatment should be started when the maximum amount of good is going to be accomplished in the minimum amount of time. To start most cases during the time that the deciduous teeth are present only tends to prolong the treatment, and little good is derived therefrom, except in the cases mentioned previously. Treatment should seldom be instigated during the transition period. There are many changes taking place during this period, and appliances will interfere with and constitute a danger to the normal growth forces which are most active at this time. I hope that these observations will help to clarify this question for you. However, I think, perhaps, the best plan when you see children who have evidence of malocclusion, no matter what their age may be, is to refer them to an orthodontist. This gives the orthodontist the

opportunity to counsel with the parent and the family dentist, and to explain in detail the procedure he feels should be followed.

We have been discussing the proper age to treat child patients. Do you know that orthodontic treatment for adults, particularly young adults, has proved very effective? A great deal can be accomplished for these patients, and they are most appreciative of the service rendered. In treating adults, complete cooperation is usually obtained, which is not always the case with the child patient. By having this splendid cooperation the treatment is pleasant, and breakage and other aggravating annoyances are reduced to a minimum. Unfortunately, the dental profession has not been correctly advised as to the possibilities for successful orthodontic treatment in the adult mouth; therefore, too few adults avail themselves of this service. The orthodontist can render valuable assistance to the prosthodontist by moving teeth into more advantageous position before bridgework and other prosthetic appliances are constructed. The field for treating adult mouths has almost as many possibilities as that for children. Of course, these cases must be carefully selected, and in many instances treatment is more or less a compromise. A great many individuals are not financially able to avail themselves of this service as children, but when they begin to earn their own livelihood are able to take advantage of it.

I mentioned as one of the causes of malocclusion the early loss of both deciduous and permanent teeth. It is so very important that deciduous teeth be retained until they would normally be lost. When a second deciduous molar is lost before the eruption of the six-year molar, the six-year molar will invariably erupt mesially, thereby causing a crowding of the premolars. If any of the posterior deciduous teeth have to be lost one to five years early, space retainers should be placed to prevent the drifting of the adjacent teeth. These space retainers can be made easily and in a few minutes' time. They need not be complicated; in fact, the simpler they are the better. I would like to put in a plea here for good dentistry for children. If all our children could have good dentistry, 90 per cent of the teeth that are lost could be saved, and a great deal of future orthodontic treatment eliminated. I know that a great many of you think that operative dentistry for children is not profitable, but it can be made profitable, and there is no phase of dentistry which is more far-reaching in its results. Lately, I have talked with several men who do a great deal of children's dentistry, and they have told me how they have made it financially profitable. I wish every city could have a specialist in children's dentistry. Then the men who do not care to treat children could send their child patients to the pedodontist. Unfortunately, we do not have men who specialize exclusively in children's dentistry in many of our Florida cities. If any of you younger men think you would like this as a specialty, I believe I can show you how you can make it both financially profitable and enjoyable.

Another mutual problem which we must face, and face honestly, is the problem of caries. Caries is rampant in the mouth of the average American child, and we seem to be making little progress in correcting this deplorable condition. I think we all realize the importance of diet, but, so far, we haven't been able to put it across to people at large. There are a few dentists who in-

dividually have accomplished a great deal in this respect, but it is going to take a united effort and many years of educating the American people before we are going to be able to reduce the incidence of caries to any marked degree. I think it behooves each of us to study and read everything in the literature regarding the prevention of dental decay. Certain individuals are not susceptible to caries, and no matter what you put into their mouths they still would not develop cavities. Unfortunately, the majority of our children do not fall in this category, but I believe it does prove a point, namely, correctly made appliances in themselves do not cause cavities to develop. Certainly, orthodontic appliances are not going to make a patient immune to caries, and, in many instances, appliances which are neglected and not properly cleaned will be a factor in causing dental decay in the mouths of children who have a high susceptibility to caries. I feel, however, that too many dentists are prone to blame all cavities that develop in the mouths of orthodontic patients entirely on the appliances. Remember, most orthodontic treatment is undertaken during the ages when caries is most prevalent—during adolescence and the early teens. In cases where a child will not cooperate in thoroughly cleaning his mouth, the orthodontist will appreciate your help in advising the patient and the parent as to the necessity of proper home care. We all realize how important this is, and every conscientious orthodontist is hammering this to his patients every day. Full cooperation from the family dentist, however, is absolutely necessary. Many children have worn orthodontic appliances who have never developed a cavity during their treatment. Other children have had many cavities. We tell our parents before treatment is started that their children are quite likely to develop cavities and that unless the appliances are properly cleaned they may have more cavities than otherwise. Please back us up on this. Children wearing orthodontic appliances should have frequent prophylactic care from their family dentist, or from the dental hygienist. I have seen, and I am sure you have, too, mouths that were completely riddled by caries where orthodontic appliances have never been worn, but, unfortunately, if this individual had worn orthodontic appliances at any time, 90 per cent of the men here would be prone to blame the entire deplorable condition on the appliances.

The next thing I would like to discuss is the necessity of extracting permanent teeth in orthodontic treatment. This question has been debated in orthodontic literature for years, some men advocating the idea of never extracting a permanent tooth and other groups believing in the extraction of the first premolars in a large number of cases. The pendulum has swung both ways. Right now there is a wave of extraction enthusiasm sweeping the country. Dr. Charles H. Tweed of Tucson, Arizona, has come out with a theory which advocates extractions, and he has many adherents. I believe the majority of men in the South have not gone in for the wholesale extraction of teeth. Most of us believe that, in certain cases and under certain conditions, extraction of premolars might be indicated and a better result produced by the removal of these teeth. Wherever teeth are to be extracted, the family dentist should be brought into consultation, and the treatment plan explained in detail. I am thoroughly convinced that certain individuals do not have the capacity for a

full complement of teeth, and, in these cases, it is impossible to maintain normal alignment of the teeth without removing some of the dental members.

Is orthodontic treatment worth while? This may sound like a silly question to some of you, but it is one worth meditating on for a few minutes. Dentists can be placed in three classes when it comes to their attitude toward orthodontics. We have the men who are thoroughly sold on it and take advantage of every opportunity to see that their patients get the best orthodontic care. These men call on the orthodontist to assist them in aligning teeth before prosthetic restorations are made. They recognize deviations from normal in their child patients and seek the advice of an orthodontist. Then we have the men who are more or less indifferent to orthodontic treatment. If their patients inquire about malformations, they say, "Yes, go and see an orthodontist," and there their interest stops. We also have men who, for some reason or another, are opposed to orthodontics. Thank goodness there are not many who fall into this class!

Of course, we have failures and relapses—all of us do. Sometimes we do not know why a case is a failure. Often we feel that there is present a strong inherited tendency which cannot be overcome. In other cases, there is undoubtedly an endocrine imbalance which makes our work very difficult. We see some children with habits which cannot be brought under control, these habits producing obstacles to maintaining normal occlusion. We have a few patients who refuse to cooperate to the extent which is necessary to accomplish good results. Yes, we have our troubles and heartaches just as you do, but the majority of orthodontic treatment is imminently beneficial and successful. This point can be proved by the simple fact that it would hardly be possible for the specialty of orthodontics to continue as a successful specialty if it were honeycombed with failures. Dr. George M. Anderson estimated from conversations with highly respected practitioners that about 15 per cent of their cases might be classified as failures, and that such a record would measure up with the best of therapeutic treatment in other branches of the healing arts. The large majority of cases remain stable and justify the effort expended in attaining them.

A great many of our so-called failures can be retreated later with gratifying results. I have recently retreated a young woman in St. Petersburg whom I treated first when she was a child in junior high school. Her treatment was not entirely successful. She went away to college, graduated, and returned to St. Petersburg to make her home. She came to see me again nine years after her appliances were removed. We advised that we try again. She was not only willing but anxious because she was very much concerned about the appearance of her teeth. We have now completed her treatment; she has a beautiful set of teeth, and she is extremely happy. I mention this little incident to illustrate several things. The first is that we are not batting 100 per cent. The second is that if our limitations are explained to the patients and parents ahead of time, they are not led to expect too much, and they understand and cooperate. Third, we need your cooperation and help. One discouraging word from this girl's family dentist and we would never have had the opportunity of completing her case successfully. Consequently, she would have gone through life unhappy about her orthodontic experience.

The esthetic value of orthodontics is enormous. I have in mind a boy who had an extreme protrusion of his maxillary anterior teeth, and, because of this condition, he became so shy and self-conscious that he threatened to quit school. He had become antisocial and had little contact with other children his age. We treated this boy with extremely gratifying results. When the war came along, he enlisted and made an enviable record, receiving several promotions in rank. This is only one instance of how many a warped personality has been completely transformed by orthodontic treatment.

The dental profession is held in high esteem throughout America today because of its wonderful progress in restorative dentistry, and not because of any great strides it has made in preventive measures. Orthodontics, on the other hand, is largely a preventive science. The records will show that most teeth lost after the age of 35 are due not to caries but to periodontal conditions which have been brought about largely by trauma and malocclusion. If the individuals in these cases had had orthodontic treatment early in life, their teeth could have been saved for many years beyond the time they had to be removed. In the correction of existing oral and facial deformities, in the prevention of dental diseases and psychological maladjustments brought on by malocclusion, orthodontics can contribute largely to making this a better world for thousands of handicapped individuals.

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FLORIDA POWER BUILDING.

EFFECT OF ZINC OXYPHOSPHATE CEMENT ON ENAMEL

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INTRODUCTION

THE effect of zinc oxyphosphate cement on enamel is of primary interest to the orthodontist and the pedodontist, who use this material most frequently to cement bands upon the enamel-covered surface of the teeth. The purpose of this study was to investigate the effects of zinc oxyphosphate cement on the enamel surface of extracted teeth.

REVIEW OF LITERATURE

Only two references pertinent to this problem were found in the literature (Lefkowitz and Bodecker, 1938,[1] and Lefkowitz, 1940[2]). They showed that (1) dyes were able to penetrate the enamel of dogs' teeth after the enamel surface had been exposed to the action of zinc oxyphosphate cement; (2) human teeth which were banded and cemented in the mouth with zinc oxyphosphate and silicate cements and extracted seven days later were found to have their enamel surfaces definitely etched. The etching was studied by means of ground sections and grenz rays.

MATERIALS AND METHODS

Number and Classes of Teeth Used.—Thirty-six recently extracted adult teeth (1 molar, 10 premolars, 10 cuspids, 15 incisors, Tables I to V) were obtained from the exodontia clinic of the University of Illinois College of Dentistry.

Preparation of Enamel Surfaces.—The teeth were cleaned by hand brush with soap and water, then wiped with cotton moistened with alcohol and ether. Thirteen of these teeth received no further preparation (Table I). On the remaining twenty-three teeth (Tables II to V), the enamel surfaces were ground perfectly flat for better future microscopic examination, using carborundum stones and disks followed by paper abrasive disks. The surfaces were then polished with fine pumice and rag wheel followed by whiting (AlO_3) and high-luster powder. These teeth were then again cleansed by hand brush with soap and water, followed by alcohol and ether.

One-half of the selected enamel surface was covered with a 50 per cent solution of collodion which was allowed to dry thoroughly. This collodion film served to protect the covered portion of the enamel from the action of the cement.

Liquid-Powder Proportions.—The action of cement liquid alone was studied on the enamel of two teeth. On all other teeth three different mixes of cement (Stratford-Cookson) were used.

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TABLE I. ACTION OF VARIOUS MIXES OF ZINC OXYPHOSPHATE CEMENT AND OF CEMENT LIQUID ALONE ON ENAMEL SURFACES*

NUMBER	TOOTH†	MATERIAL USED	DEGREE OF ETCHING
1	Cuspid	Cement liquid alone	Severe
3	Premolar	Thin mix	Very slight
4	Premolar	Thin mix	Very slight
15A	Incisor	Thin mix	Very slight
16A	Cuspid	Thin mix	Very slight
18A	Cuspid	Thin mix	Very slight
7	Premolar	Medium mix	Very slight
8	Incisor	Medium mix	Very slight
10A	Cuspid	Medium mix	Very slight
11A	Premolar	Medium mix	Very slight
12A	Premolar	Medium mix	Very slight
13A	Premolar	Medium mix	Very slight
14A	Cuspid	Thick mix	Very slight

*Length of time of application in all cases was twenty-four hours except No. 1, in which the cement liquid was applied for five minutes.

†Labial or buccal surface used in all cases except No. 3, which was lingual.

TABLE II. ACTION OF VARIOUS MIXES OF ZINC OXYPHOSPHATE CEMENT AND OF CEMENT LIQUID ALONE ON GROUND AND POLISHED ENAMEL SURFACES*

NUMBER	TOOTH†	MATERIAL USED	DEGREE OF ETCHING
2	Molar	Cement liquid alone	Severe
5	Cuspid	Thin mix	Moderate
6	Incisor	Thin mix	Moderate
8A	Cuspid	Thin mix	Moderate
9A	Cuspid	Thin mix	Moderate
20A	Incisor	Thin mix	Moderate
21A	Premolar	Thin mix	Moderate
9	Premolar	Medium mix	Moderate
10	Incisor	Medium mix	Moderate
1A	Premolar	Medium mix	Slight
2A	Cuspid	Medium mix	Slight
4A	Incisor	Medium mix	Slight
6A	Premolar	Medium mix	Slight
12	Incisor	Thick mix	Slight
7A	Incisor	Thick mix	Slight

*Length of time of application in all cases was twenty-four hours except No. 2, in which the cement liquid was applied for five minutes.

†Labial or buccal surfaces used in all cases.

1. Thin Mix.—The consistency of the mix was considered to be thin if the cement, after spatulation, flowed freely from the edge of the lifted spatula.

2. Medium Mix.—The medium mix was of a creamy consistency and followed the lifted spatula to a height of three-fourths of an inch.

3. Thick Mix.—A thick mix was considered to be one in which the cement would not follow the spatula when lifted from the slab.

The spatulation time varied from one to three minutes.

Setting Time.—Setting time was considered to have been reached when the cement was uniformly hardened and the heat of reaction had ceased.

Removal of the Adherent Cement.—The cement and collodion were removed after predetermined periods of time. The cement chipped away easily, usually in one piece. The collodion was removed with ether. To remove adhering particles of cement, the teeth were rescrubbed with hand brush, soap, and water, followed by alcohol and ether, then allowed to dry.

TABLE III. ACTION OF THIN MIX OF ZINC OXYPHOSPHATE CEMENT ON GROUND AND POLISHED ENAMEL SURFACES OVER VARYING LENGTHS OF TIME*

NUMBER	TOOTH	LENGTH OF TIME OF APPLICATION (HOURS)	DEGREE OF ETCHING
13	Incisor	1	Slight
14	Incisor	1	Moderate
15	Incisor	3	Slight
16	Incisor	3	Moderate
17	Cuspid	6	Moderate
18	Incisor	6	Moderate
19	Incisor	12	Moderate
20	Incisor	12	Moderate

*Labial surfaces used in all cases.

TABLE IV. ACTION OF ZINC OXYPHOSPHATE CEMENT ON GROUND AND POLISHED LABIAL SURFACES OF ENAMEL, FOR LENGTHS OF TIME CORRESPONDING TO SETTING, TWICE SETTING, AND HALF SETTING TIME OF CEMENT*

NUMBER	TOOTH	LENGTH OF TIME OF APPLICATION (MINUTES)	DEGREE OF ETCHING
13	Incisor	40	Slight
14	Incisor	40	Very slight
15	Incisor	20	Moderate
16	Incisor	20	Very slight
17	Cuspid	80	Very slight
18	Incisor	80	Slight

*Medium mix of cement was used in all cases.

TABLE V. ACTION OF ZINC OXYPHOSPHATE CEMENT ON GROUND AND POLISHED LABIAL SURFACES OF ENAMEL WHEN CEMENT POWDER WAS INCORPORATED IN BULK AND IN SMALL PORTIONS*

NUMBER	TOOTH	CEMENT MIX	DEGREE OF ETCHING
19	Incisor	In bulk	Slight
6	Incisor	In bulk	Slight
10	Incisor	In portions	Very slight

*A medium mix of cement was used in all cases.

Methods of Examination.—The enamel surfaces were examined by direct observation and with a binocular dissecting microscope (16X and 32X) using reflected light. Fax-film impressions were then taken of the enamel surfaces following the technique described by Gurney and Rapp (1946).[3] These microimpressions were examined by reflected light under a binocular scope (16X and 32X) and by transmitted light under a standard microscope at magnifications of 50X, 100X, and 450X.

Procedure.—Five series of experiments were carried out. The action of zinc oxyphosphate cement was studied on:

1. Unground enamel surfaces of extracted teeth using cement liquid alone and different mixes of cement (Table I).
2. Ground and polished enamel surfaces using cement liquid alone and different mixes of cement (Table II).
3. Ground and polished enamel surfaces using a thin mix of cement which was allowed to remain on the enamel surface for periods of time varying from one to twelve hours (Table III).

4. Ground and polished surfaces using a medium mix of cement which was removed from surface of enamel when set (forty minutes), at twice setting time (eighty minutes), and half setting time (twenty minutes (Table IV).
5. Ground and polished enamel surfaces using a medium mix of cement which had the powder incorporated into the liquid in bulk and in small portions (Table V).

FINDINGS

Series 1. Action of Cement Liquid Alone and of Different Mixes of Cement on Unground Enamel Surfaces (Table I).—The action of the cement liquid alone was very definite. The area not protected by the collodion appeared etched throughout.

The unprotected surfaces subjected to the action of the cement were only slightly affected. On surfaces upon which thin, medium, and hard mixes were used, it was difficult to differentiate between the exposed and protected areas. Surprisingly enough, no difference could be observed in the degree of etching on surfaces that were exposed to the action of thin, medium, or hard cement mixes.

Series 2. Action of Cement Liquid Alone and of Different Mixes of Cement on Ground and Polished Enamel Surfaces (Table II).—On ground and polished surfaces of Series 2, the degree of etching was greater than on the unground enamel surfaces of Series 1. The surface that was exposed to cement liquid alone again showed a deeper etching than the surfaces exposed to thin, medium, and hard mixes of cement (Fig. 1).

The enamel surfaces that were under the cement mixes showed varied degrees of etching, suggesting that the action of the cement was not uniform over the entire surface of the enamel (Figs. 2, 3, 4, and 5).

The etched surface was sharply and definitely demarcated from the unetched (protected) surface which had been covered with collodion. This demarcation was more prominent on the ground enamel surface, while the demarcation was comparatively slight on the unground enamel surfaces.

There was, thus, a distinct difference in the effect of both the liquid alone and of the cement upon the enamel surface which was ground and the enamel surface which had been thoroughly cleaned but had not been ground. Etching of varying degrees was observed on all ground enamel surfaces, but was comparatively slight on the enamel surfaces which had not been ground.

Series 3. Action of Thin Mix of Cement on Ground and Polished Enamel Surfaces Over Varying Lengths of Time (Table III).—The unprotected surfaces of enamel in this series were found to be etched even when the cement was removed after one hour. However, no difference in the degree of etching could be found among the enamel surfaces that were subjected to the action of the cement for three, six, or twelve hours. There was some question as to whether the one-hour specimen was slightly less etched than the three-hour specimen. Apparently, the length of time above three hours during which the cement was allowed to remain on the enamel surface was not a factor in the degree of etching. (Figs. 3, 4, and 5.)

It should be noted in this time relationship that the thin mix of cement was not completely set at the end of the first hour. It was, therefore, decided to use a medium mix of cement and to relate the time factor to the setting time of the cement.

Fig. 1. Fig. 2.

Fig. 3. Fig. 4. Fig. 5.

Figures illustrating the action of zinc oxyphosphate cement on the enamel surface. The surface of the enamel in these specimens was ground flat (for photographic convenience) and polished before being subjected to the action of the cement. *A*, Area protected from action of cement by a film of collodion. *B*, Area exposed to action of the cement.

Fig. 1.—Action of cement liquid alone. Time of application, five minutes.
Fig. 2.—Action of a hard mix of cement. Time of application, twenty-four hours.
Fig. 3.—Action of a thin mix of cement. Time of application, one hour.
Fig. 4.—Same as in Fig. 3. Time of application, six hours.
Fig. 5.—Same as in Fig. 3. Time of application, twelve hours.

Series 4. Action of a Medium Mix of Cement on Ground and Polished Enamel Surfaces for Lengths of Time Corresponding to Setting, Twice Setting, and Half Setting Time (Table IV).—The etching of the enamel surfaces of the teeth in this series was definite, but here again the degree of etching appeared to be the same for all three time intervals (setting time, twice setting time, and half setting time). It is reasonable to infer, therefore, that the action of the cement upon the enamel surface takes place during its setting.

Series 5. Action of Medium Mix of Cement on Ground and Polished Surfaces of Enamel When Cement Powder Was Incorporated in Bulk and in Small Portions.—The method of mixing the cement materially affected the setting time of the cement. When the powder was incorporated in bulk rather than in divided portions, the setting time was reduced one-tenth (four minutes instead of forty minutes).

No difference in the degree of etching could be observed between cement mixed in bulk and cement mixed in small portions.

DISCUSSION

Very little has been written on the effect of cement on enamel surfaces. Leftowitz (1940)[2] reported on the histologic evidence of the harmful effect of cement under orthodontic bands. He found that dental cements etched ("decalcified") the enamel surfaces of teeth in vivo after the bands had been left on for a period of seven days.

This report indicates the effects upon recently extracted teeth. There is no reason to believe that the effects should be markedly different in vivo or in vitro, since enamel is essentially a nonvital tissue. However, our results might have shown some variations if they had been carried on in vivo instead of in vitro.

The intact enamel surfaces of 75 per cent of the teeth were etched by all the various mixes, but not as markedly as on the ground and polished surfaces. This might mean that a "protective film" is present which prevents to some extent, at least, the decalcifying action of the cement mix, despite the mechanical cleansing with hand brush and soap and water followed by ether and alcohol.

Several investigators have described a "protective film" on the surface of the enamel which seems to protect the tooth against dental decay. Chase (1926)[4] reviewed the theories concerning the nature of this film. Bibby and Van Huysen (1933)[5] have discussed its nature. All investigators agree that when a tooth is treated with dilute acids, a definite membranelike pigmented structure can be separated from the surface of the crown. This film or membrane is resistant to acids and to bacterial action. Recently, Bruderwold[6] emphasized the acid-resistant character of the enamel surface and greater solubility of the deeper enamel. Sognnaes[7] demonstrated an intact surface membrane on the enamel by floating it free in dilute acids.

On the teeth which showed etching, the entire enamel surface was not evenly affected. This might be due to some surface tension phenomena which prevented the close adherence of the cement to the enamel surface evenly over the entire enamel surface. It would be an interesting and perhaps useful experiment to lower the surface tension of the cement and determine whether the etching would

become more homogeneous. This might lead to a method of making the cement more adherent to the enamel surface.

The amount of etching which took place at the end of the setting time of any of the cement mixes could not be differentiated from that which took place within a twenty-four-hour period. Neither did the consistency of the mix nor the method of mixing materially affect the amount and degree of etching. Evidently, the enamel is affected during the setting time, and prolonged contact after the cement has set did not affect the enamel further. This would lead to the conclusion that repeated cementings would be disadvantageous to the enamel surface.

The inability to differentiate between the degree of etching produced by the mixes which set in four minutes and forty minutes is possibly due to inadequate objective methods of measuring such differences.

The cement adhered to the collodion-covered enamel surface just as firmly as it did to the exposed enamel surface. Since the collodion served as a protective film which prevented the etching action of the cement on the enamel, a method is suggested of protecting the enamel surface of teeth which are to be banded against the etching action of cement.

SUMMARY AND CONCLUSIONS

This report deals with the effect of zinc oxyphosphate cement on enamel surfaces.

A series of thirty-six recently extracted teeth were used. The effects of cement on ground and unground enamel surfaces were studied.

1. Cement liquid alone etched the enamel markedly and hemogeneously.
2. All enamel surfaces exposed to the action of various mixes of cement were more or less affected.
3. The etching was more prominent on the ground surface than on the unground surface. This might indicate the presence of a "protective film" on the surface of the intact enamel.
4. The etching was spotty or circumscribed, indicating a partial adherence of cement to enamel surface.
5. The degree of etching did not seem to increase after the cement was completely set.
6. The cement liquid alone and the cement mixes did not affect the enamel surfaces covered by a film of collodion.

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808 S. Wood Street

AN ECONOMICAL AND RAPID TECHNIQUE FOR OBTAINING ROENTGENOGRAMS OF THE HAND

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INTRODUCTION

ROENTGENOGRAMS of the hand have been used extensively by research workers in the field of growth and development. Some of their findings and methods of analysis could and should be used more extensively and routinely by pediatricians, pedodontists, and orthodontists. In addition, many more hand plates could be taken routinely by hospitals and clinics if the cost and time involved were not excessive. The following technique is offered as a method of obtaining roentgenograms of the hand quickly and inexpensively.

MATERIALS AND METHODS

Fast projection printing paper is used instead of the usual roentgenographic film. Two different brands of paper were tried: a very fast projection paper with waterproofed backing manufactured by the Grant Photo Products, Inc., Cleveland, Ohio, under the trade name of Quix, and Royal Bromide, manufactured by the Eastman Kodak Company. Contrasts No. 1 and No. 2 were tried (Table I).

Table I. Exposure Data

PAPER	CONTRAST	YOUNG CHILDREN	OLDER CHILDREN	ADULTS
Royal Bromide	F-1	1.5 seconds	3 seconds	3.5 seconds
Quix—projection	No. 1	1.0 second	2.5 seconds	3 seconds

Machine used: Dental x-ray (portable). Kv.: 1; Amp.: 15.
Paper to cone distance: 22 inches.
Developer: D-72 or x-ray developer for two minutes at 68° F.
Contrast grade No. 2 paper will give somewhat slower speed and greater contrast but less detail.

A regular dental x-ray machine of 15 amp. and 1,000 watts was used. The tube of the machine with the cone removed was pointed perpendicular to a table surface at a distance of twenty-two inches. Cassettes (5 by 7 and 8 by 10 inches) with intensifying screens were loaded with the projection papers, and trial exposures were made. The papers were then developed in standard paper developer (D-72) for a period of two minutes and were fixed, washed, and dried in the usual manner.

Since the paper is much less sensitive to dim light than the roentgenographic film, the ordinary dark room set-up is quite adequate. Development can be easily followed under subdued light and completed by inspection, a distinct advantage when expert technical assistance is not available.

From the Child Research Clinic, University of Illinois, College of Dentistry.

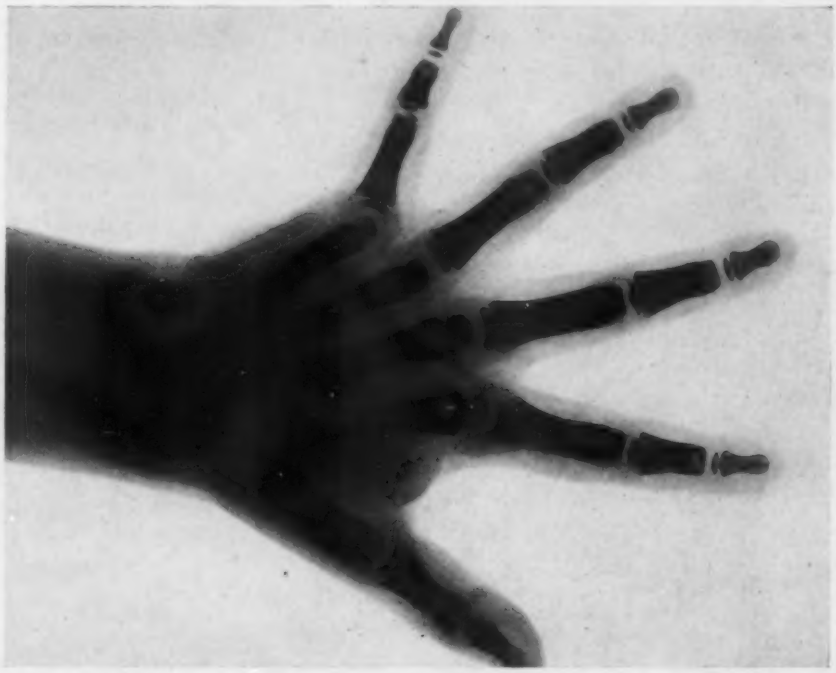

Fig. 1.—Roentgenogram of the hand of a 5½-year-old female child on regular x-ray film. Exposure, three-fourths second (without intensifying screen).

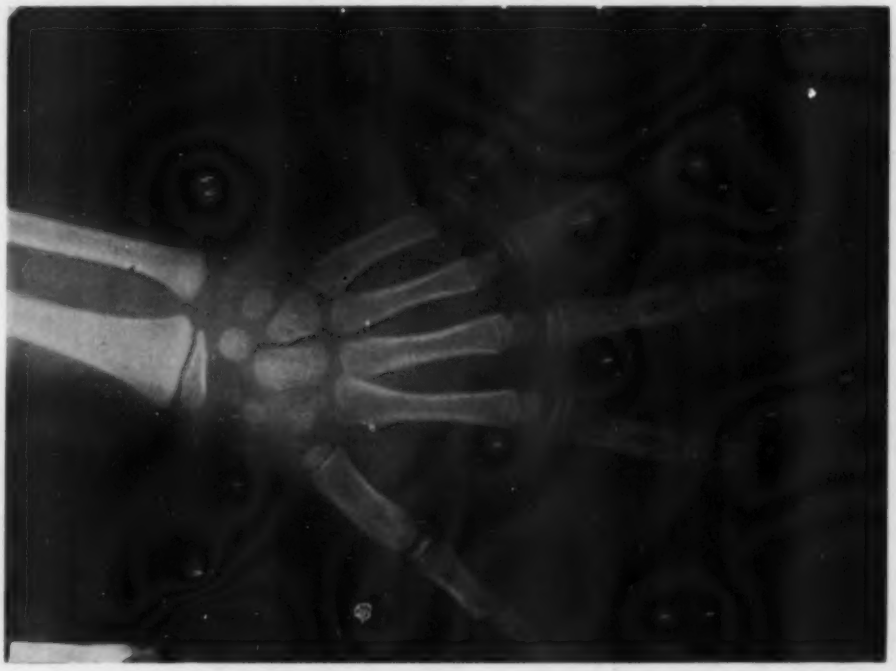

Fig. 2.—Roentgenogram of the same hand on Quix paper, No. 1. Exposure, three-fourths second (with intensifying screen).

FINDINGS

The widest gradation of grays and, therefore, the greatest amount of detail was obtained with the No. 1 contrast papers. Although the detail was not as great as that obtained on film, it was entirely adequate for most routine clinical purposes. The No. 2 paper gave greater contrast but less detail.

The exposure time varied with the age of the patient and the type of paper used (Table I).

Fig. 3.—Roentgenogram of the same hand on Quix paper, No. 2. Exposure, one and one-fourth seconds (with intensifying screen).

The waterproofed paper has several advantages worth mentioning. It is fast in: (a) exposure, (b) developing, (c) fixing, (d) washing, and (e) drying. The time from the beginning of development to the finished print requires less than ten minutes—with no mechanical aids.

DISCUSSION

This technique can be utilized by any clinic or practitioner who has a dental x-ray machine available. The time consumed as compared with taking the same hand plate with film is greatly reduced, while the cost is also much less than that of film.

The details for assessment of maturation and growth phenomena are adequate. No special viewing boxes are necessary, and normal handling will mar the paper much less than the film.

SUMMARY AND CONCLUSIONS

This paper describes a simple, economical, and rapid technique for obtaining hand plates.

Instead of film, a fast, full-scale projection paper was loaded into the film cassettes with intensifying screens.

The results showed that while the detail was not as great as that shown on film, it was, nevertheless, surprisingly good and quite adequate for the analysis of growth and maturation phenomena.

The cost of the paper is much less than that of film.

The time involved is much less than that required when film is used.

No special equipment or dark room facilities are necessary.

CLASS I (NEUTROCLUSION)

Case Report

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THE following report is not that of an unusual case. Every orthodontist sees these cases many times in his practice because the etiological factors are so common. I merely report it because it was one which responded to treatment without extraction, did not produce facial unbalance, and has remained stable over a period of years.

The case was a Class I or neutroclusion case of a young girl about 14 years of age (Fig. 1). Her history was nothing unusual. She was nursed up to 3 months of age, then bottle fed. She contracted whooping cough at 2 years, measles at 5 years, chicken pox at 5 years, 6 months, and scarlet fever at 10 years. The face was the tapering type with what seemed a fairly normal musculature.

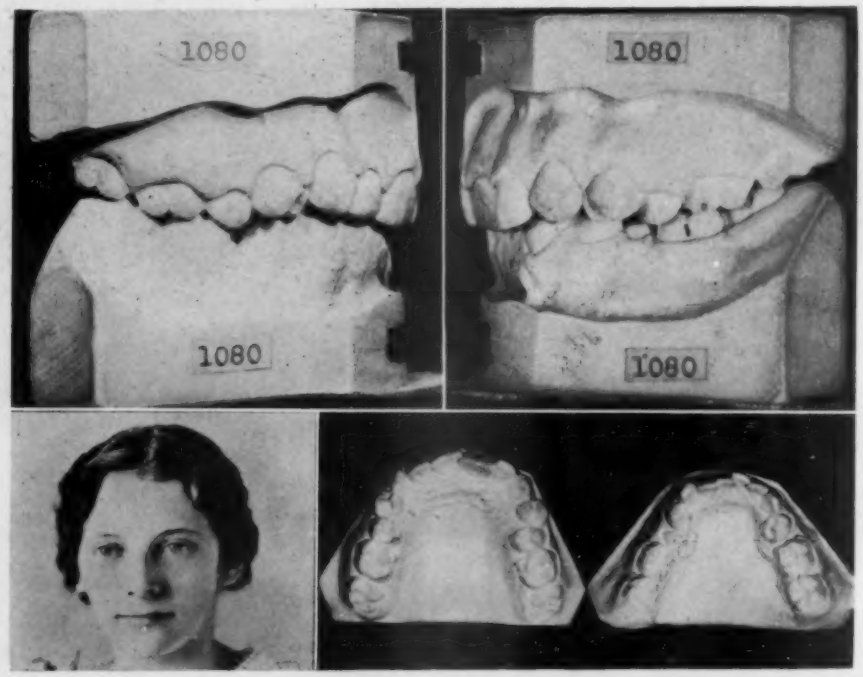

Fig. 1.—Unfortunately, the profile view was lost.

Due to the early loss of the second deciduous molars, the premolars were blocked out almost completely on the right side, but this was not quite so marked on the left side. Both premolars were unusually large. There was a mesial

Presented at the Meeting of the Central Section of the American Association of Orthodontists, Minneapolis, Minn., April 15, 1947.

drift of the permanent molars on both sides with a consequent shortening of the lower arch, and this, of course, was followed by an adjustment of the upper arch which manifested itself by a deep overbite and with the upper premolars occluding buccally to the lower premolars.

The objectives were to establish sufficient space for the lower second premolars and to restore normal interdigitation of the lower and upper teeth.

Fig. 2.

I felt that with the added anchorage which the deep overbite afforded, together with the eight lower anterior teeth, I might have sufficient anchorage without having the lower arch moved off its base. An edgewise arch appliance was placed in the lower with ribbon arch end sections on the molars. The patient was instructed to turn a nut anterior to the tube on the threaded section of the arch one-quarter turn every three days. At the end of ten months, enough space had been gained for the second premolars. They were banded, the ribbon arch end sections were removed, an ideal arch was placed, and normal arch form was restored.

The teeth in the upper arch were now banded, normal arch form obtained, and due to the fact that there was, without doubt, forward movement of the lowers, a slight amount of arch relation had to be corrected through the wearing of intermaxillary elastics. This was accomplished, and the after results of both models and photographs appear in Fig. 2.

324 E. Wisconsin Avenue

In Memoriam

HUGH G. TANZEY

1869—1948

HUGH G. TANZEY, of Kansas City, Missouri, another one of the pioneer orthodontists, died Jan. 8, 1948, after an illness of three months.

Dr. Tanzey was born in Paris, Missouri, Feb. 28, 1869, the son of Mr. and Mrs. J. Nelson Tanzey. After graduation from high school, he studied in the offices of Dr. R. M. Burgess, a dentist in Paris. Later, he attended the Old Western Dental College and was graduated with a D.D.S. degree in 1901. After studying orthodontics in St. Louis, he practiced at Cameron, Missouri until he moved to Kansas City in 1910.

In 1908, he married Miss Eunice de Steiguer of Cameron, who survives.

In 1916, he became president of the Western Dental College and in 1918, when it was merged with the Kansas City Dental College, he became president of the Kansas City Western Dental College. He held that position ten years. The college became part of the University of Kansas City in July, 1941.

In 1915, he helped organize the International School of Orthodontia here and remained president until it was dissolved in the middle 1930's.

He was former president of *Xi Psi Phi,* dental fraternity, and former president of the Kansas City District Dental Society. He had been a member of the American Association of Orthodontists, the Missouri Dental Association, the American Dental Association, and the district dental society.

Dr. Tanzey, along with Dr. Brady, for many years conducted the International School of Orthodontia in Kansas City, Missouri. This school was discontinued about the time that orthodontic instruction was taken over by the university educational institutions.

Surviving besides his wife are two daughters, Mrs. Fred Bellemere, Jr., and Mrs. Paul Jordan, both of Kansas City, Missouri.

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Annual Review of Physiology: By Victor E. Hall, Editor, Stanford University; Jefferson M. Crimson, Associate Editor, Stanford University; Arthur C. Giese, Associate Editor, Stanford University. Stanford University, Calif., Annual Reviews, Inc., and American Physiological Society, 1947, Vol. IX, pp. vii—736.

This is Volume IX in this series which is intended to make available to the scientific world the significant developments in physiology that come annually from the efforts of workers in all nations. "Growth," by Reimann, reviews the "organizers" and presents information on the chemical aspects of induction. An article by Thoma and Goldman is mentioned in which the inductive aspects of odontogenic tumors are discussed and classified as epithelial, mesenchymal, and mixed. There is a possibility that in mixed tumors such as odontogenic, salivary glands, and others, the origin may hark back to the organizer stage of the embryo.

Fluorine, it is shown, may have an enzymic action, and the carbonato apatite of the tooth may be converted into a less soluble fluor apatite. Evidence has been presented to show that effects of the fluorine on the tooth are mitigated by calcium. Calcification changes caused in the teeth by fluorine have been studied histologically. Articles are reviewed on the "Nature of the Mineral Substance on the Bones and Teeth" by P. D. F. Murray. A new thought has been brought out in x-ray diffraction studies. Studies of the birefringence of bone have led to the conclusion that its microscopic architecture is related to the vascular pattern rather than to external form or mechanical function. Thus, the architecture of the human femur could be presented as a pure growth structure, function playing no necessary part, but alterations in the architecture are in accord with mechanical principles. Muscular function forces play a part in the development of torsion in the humerus. The role of function and other factors in the development and maintenance of structure as studied in the jaws and teeth of fetuses and in form changes of the edentulous mandible. References are given to all of the foregoing.

It will be of interest to orthodontists to know that much can be learned from physiologic processes which take place in the repair of fractures. Dallemagne found in bone repair of rabbits that there is a demineralization of both stumps of the broken bone preceded in the proximal piece by an accumulation of mineral in the first few days after fracture. The demineralization stops long before the repair tissue is fully calcified. Demineralization is attributed to vasodilatation and resultant local acidity. Rachitogenic diets and vitamin A deficiency greatly delay the repair of fractures in laboratory animals, while parathyroid hormones and vitamin D accelerate mineralization of the callus. Articles are reviewed on the nutrition of the teeth through both the blood stream and the saliva. According to Roche, calcification proceeds in four stages: "a. phosphate and calcium ions are fixed simultaneously but independently to the 'pre-osseous substances'; b. the pre-osseous substance undergoes a trans-

formation whereby it becomes the organic matrix of the bone, and the calcium and phosphate ions are liberated; c. these combine, an insoluble calcium phosphate is precipitated; and d. is fixed to the proteins of the organic matrix."

The effect of the endocrine glands on skeletal growth shows that thyroidectomy delays ossification and tooth eruption while testosterone propionate reactivates growth. It is gratifying to find the *Annual Review of Physiology* giving due consideration to the work of dental research men. This book will be found of great interest to orthodontists since it will acquaint them with the work done by men in the cognate field of physiology.

American Illustrated Medical Dictionary: By W. A. Newman Dorland, A.M., M.D., F.A.C.S., Lieutenant Colonel, M.R.C. United States Army, Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association, Editor of *American Pocket Medical Dictionary*. With collaboration of E. C. L. Miller, M.D., Medical College of Virginia. Ed. 21, Philadelphia and London, W. B. Saunders Co., 1947, pp. 1,660, with 880 illustrations including 233 portraits.

In this edition of the Dictionary, the attempt has been made to include the numerous additions to medical terminology which were accumulated during the war years. This is especially true of diseases related to aviation. Thus we have 'aerodontalgia' and the synonyms, 'aero-odontalgia' and 'aero-odontodynia,' although the term 'aerodontia' does not appear. In our experience we have never come across 'buccilingual' in the dental or orthodontic literature. We are wondering whether dental authorities were consulted by the editors.

Of especial interest to dentists and orthodontists will be the inclusion of new terms related to the employment of newer methods and materials. Throughout, special attention has been given to the wording of definitions so that while encyclopedic descriptions are avoided, sufficient information is provided to allow for more than the abridged student's dictionaries. Under each drug is given its composition, sources, properties, usage, and dose. Many useful illustrations have been included; also that portraying the molar tooth leaves much to be desired.

Definition of a "Quack": By John Rickman, *Brit. M. J.* **2**: 363, Sept. 6, 1947.

"A quack may be defined as a person who seeks to establish a quasi-professional relation to a client (or patient) without having first submitted himself to a course of training regarded as adequate by the teachers in that profession; who makes no consistent endeavour to integrate any discovery he may make in the exercise of the profession to the body of knowledge already existing—to the end that the range of experience of the next generation of students may be improved; who when in a difficulty with diagnosis and treatment does not call in a brother-practitioner, laying before him all the facts known, being ready to accept the advice offered, or who would not be willing, if called in by a brother-practitioner, to put his experience fully at his disposal and return the patient to his own practitioner, not trying to keep him for himself; and who is unwilling to submit himself to the discipline of the organizations of his profession in matters affecting his ethical relations to his patients.

"The definition turns on four things: on the willingness to learn in due

humility from an older generation, to give without arrogance to the next generation, to treat one's own generation with generosity as equals, and to submit to a social code.

"Most of the articles on quacks enlarge on the practitioner-patient relationship; ought not more consideration be given to the relation existing between persons in the same field of social activity—namely, brother practitioners?"

Extraction of Teeth During the Developmental Period of Dentition (Om ekstraksjoner under utviklingen av tannsettet): By Kaare Reitan, Oslo, Den Norsk. Tannlaege. Tid. **56**: 353-376, October, 1946.

Due to the great incidence of caries, until recently, extraction of teeth in young patients was common in Norway. On the other hand, rickets played a certain role in the jaw development, implying malocclusion especially of the Angle Class II type. During recent years, however, there is definite decrease in the number of subrachitic as well as rachitic cases.

According to new investigations (Toverud), there is also a notable amelioration in the caries frequency. Therefore at present the problem of extraction of teeth, during the developmental period, will have to be revised. It is pointed out that the systematic extraction of six-year molars in a great many cases may lead to lingual inclination of the anterior teeth, deep bite, and traumatic occlusion. Removal of all six-year molars may lead to marked changes in the patient's profile and facial lines as well. If, in some cases, reduction in the tooth number is necessary, this should be done in the premolar region.

These facts taken into consideration, the treatment planning with regard to extraction may be summarized as follows:

1. The deciduous dentition should be kept intact where the number of teeth is concerned. Space retainers should be applied in cases where deciduous teeth have to be sacrificed.

2. With systematic roentgen control of approximate caries from the age of 3 years, extractions in the deciduous dentition may be avoided.

3. Intruded deciduous molars or submerged teeth should be extracted at the age of 9 to 10 years and space retainer applied until eruption of the permanent teeth.

4. A correct mesiodistal relationship of the lower and upper canines is of importance in maintaining a stable occlusion during life. Extractions of molars in young patients is therefore contraindicated, lest untoward secondary tooth wandering should occur.

5. The muscle function plays an important part in secondary tooth wandering.

6. Systematic extraction of six-year molars should be avoided, as it may cause traumatic occlusion and unfavorable changes with regard to the patient's profile and facial lines.

News and Notes

The Clinics for the Meeting of the American Association of Orthodontists, Neil House, Columbus, Ohio, April 26, 27, 28, and 29, 1948

As has been the custom at previous meetings of the American Association of Orthodontists, Thursday afternoon will be devoted to clinics. We are especially fortunate this year, under the direction of Dr. Frederick W. Black of Cincinnati, to have some very instructive clinics. The material has been selected with a view of presenting a diversified program.

Due to the large advance registration, the reservations at the Neil House, headquarters hotel, have been exhausted. However, fine reservations may still be obtained at the Deshler-Wallick, less than one-half square away.

Deshler-Wallick Hotel

Neil House

A complete listing of the clinicians and their subjects follows:

2:15 P.M.—*Table Clinics*

Orthodontic Models and Model Former. Samuel Ackerman, Cincinnati, Ohio.

Aids in Speech Corrections. Walter K. Appel, Cheyenne, Wyo.

Retention of Bite Plates and Retainer Plates. R. E. Barnes, Cleveland, Ohio.

Derivation of Arch Form. J. William Adams, Indianapolis, Ind.

An Adjunct to Mandibular Anchorage in the Johnson Technique. Henry U. Barber, Jr., New York, N. Y.

Surgical and Orthodontic Correction in Cases of Extreme Malocclusion. Gerald V. Barrow, Ann Arbor, Mich.

Functional Analysis of Malocclusion. Vernon Boman and T. M. Graber, Chicago, Ill.

Practice Application of the Labio-Lingual Technique With Special Emphasis on Occlusal Guide Plane. Frank P. Bowyer, Knoxville, Tenn., William H. Oliver, Nashville, Tenn., Boyd Tarpley, Birmingham, Ala., and Hal Terry, Miami, Fla.

Sheet Plexiglas Johnson Shield. William S. Brandhorst, Ann Arbor, Mich.

Prefabricated Lingual Arches. A. B. Brusse, Denver, Colo., and E. S. Linderholm, Denver, Colo.

Impacted Cuspid. J. Lyndon Carman, Denver, Colo.

The Use of the Russell Attachment. Meyer Eggnatz, Baltimore, Md.

Construction and Practical Application of the Atkinson Appliance. Samuel Fastlicht, Mexico City, Mexico.

Reinforced Flexible Acrylic Positioners. G. Vernon Fisk, Toronto, Canada.

Swivel Tube Attachments for Use in Open-Bite Cases. W. A. Giblin, Montclair, N. J.

Construction and Use of the Holmes Attachment. Scott Holmes, Muskegon, Mich., Carl Anderson, Grand Rapids, Mich., and Victor Ver Meulen, Grand Rapids, Mich.

Tooth Movement Related to Supporting Bone. Ashley E. Howes, New Rochelle, N. Y.

A Correlation of Concept-Objectives and Appliances. Andrew F. Jackson, Philadelphia, Pa., and John M. Jackson, Philadelphia, Pa.

Easy and Proper Methods of Treating Difficult Cases. William M. Jarrett, Charleston, W. Va.

Useful Auxiliaries to the Twin Arch Wire. Edward E. Johns, Kingston, Ontario, Canada.

The Use of Plexiglas as an Aid in the Prevention of Tongue, Lip, and Finger Habits. Reburn R. McIntyre, Calgary, Alta, Canada.

New Method for Fabricating Twin Arches. Dan C. Peavy, San Antonio, Texas.

Habits in Action (A Motion Picture Study). Kyrle W. Preis, Baltimore, Md.

Orthodontic Propulsion—A New Force in the Atomic Age. (Also a Motion Picture in Technicolor).

Experimental Progress in a Group of Extreme Deformities. Cecil S. Rand, San Francisco, Calif.

Mesioclusion Cases Treated in Deciduous and Mixed Dentition Showing Oliver Incisal Guide Planes Used. John W. Richmond, Kansas City, Kan.

An Elastic Appliance for Treatment and Prevention of Irregularities of the Teeth. Orrin Remensnyder, Saginaw, Mich.

Practical Aids in the Prevention and Interception of Malocclusion. J. A. Salzmann and David Mossberg, New York, N. Y.

Six Unusual Cases in Orthodontic Diagnosis. H. L. Shehan, Jackson, Mich.

Atypical Problems in Orthodontics. Harry H. Sorrels, Oklahoma City, Okla.

The Use of Second Deciduous Molars as Anchorage for Early and Preventive Treatment for the Younger Patient. A. B. Thompson, Des Moines, Iowa.

Results of Treatment With Angle Edgewise Arch Appliance. Will M. Thompson, Jr., Pittsburgh, Pa.

Simple Methods for the Control of Aberrant Permanent Teeth. J. Romal White, Peoria, Ill.

Motion Pictures

Serial Study of Occlusion. J. H. Sillman, New York, N. Y.

Orthodontic Bite Raising. (Also as an Adjunct to Prosthesis.) Jacob Stolzenberg, Brooklyn, N. Y.

Surgical Procedure for Correcting Mandibular Prognathism. Edward Reiter, Cleveland, Ohio.

American Board of Orthodontics

The 1948 meeting of the American Board of Orthodontics will be held at the Deshler-Wallick Hotel, Columbus, Ohio, April 23, 24, 25, and 26. Orthodontists who may desire to be certificated by the Board may obtain application blanks from the Secretary, Dr. Bernard G. deVries, 705 Medical Arts Building, Minneapolis 2, Minnesota.

Northeastern Society of Orthodontists

The annual meeting of the Northeastern Society of Orthodontists will be held at the Chalfont-Haddon Hall, Atlantic City, New Jersey, on Monday and Tuesday, March 1 and 2, 1948.

Meeting of the Southwestern Society of Orthodontists

The Twenty-Seventh Annual Meeting of the Southwestern Society of Orthodontists was held Monday, Tuesday, and Wednesday, Feb. 2, 3, and 4, 1948, at the Hotel Broadview, Wichita, Kansas. Under the leadership of Dr. R. E. Olson, President, his officers and committees, the meeting began on Monday morning at nine o'clock.

Dr. R. E. Olson called the meeting to order, and the Address of Welcome, given by Dr. Glenn A. Thomas, President of the Wichita Dental Society followed. The response was made by Hamilton D. Harper of Shreveport, Louisiana, and this was followed by the President's Address by Dr. Olson.

Other papers in the order of their presentation were:

Speech Disorders and Orthodontics. Martin F. Palmer, B.A., M.A., Sc.D.
My Swan Song. Clinton C. Howard, D.D.S., Oakley, S. C.
The Treatment of Malocclusion. I. Active Phase-Mechanics of Appliances. II. Passive Phase-Adjustment of Occlusal Level Reduction of Bimaxillary Protrusion Retention. Alexander Sved, D.D.S., New York, N. Y.
The Significance of Proper Mechanical Therapy in Orthodontic Treatment. I. Knowledge of the Involvement of Physiobiologic Factors. II. The Importance of Knowing the Mechanical Principles of the Appliance. III. Skill in Manipulating the Appliance. George Y. Nagamoto, D.D.S., Kansas City, Mo.
Case Report. Prerestorative Orthodontics. Dan C. Peavy, D.D.S., San Antonio, Texas.
Case Report. Class II, Division 1 Case Complicated by a Complete Bilateral Cross-Bite. Robert E. Gaylord, D.D.S., Dallas, Texas.
Continuation. Development as Contrasted to Growth. Clinton C. Howard, D.D.S., Oakley, S. C.

A banquet was given for Dr. Clinton C. Howard on the evening of Tuesday, February 3, as a testimonial to his contributions to orthodontic progress. Dr. Howard, now retired, lives in Oakley, South Carolina.

Central Section of the American Association of Orthodontists

The regular annual meeting of the Central Section of the American Association of Orthodontists will be held Oct. 25 and 26, 1948, at the Corn Husker Hotel, Lincoln, Nebraska.

Cincinnati Dental Society

The Cincinnati Dental Society takes pleasure in the announcement of the Cincinnati Dental Society March Clinic and Children's Dental Health Day, March 14, 15, and 16, 1948, Netherland Plaza Hotel.

Orthodontic Directory of the World

The fourteenth edition of the *Orthodontic Directory of the World* is expected to be off the press about April 1, 1948. The editor is Dr. Oren A. Oliver, 1915 Broadway, Nashville, Tennessee.

European Orthodontic Society

The dates of the meeting of the European Orthodontic Society have been changed to Friday, Saturday, and Monday, July 16, 17, and 19, 1948. The change was made for the convenience of European colleagues and because of the meeting of the American Dental Society of Europe, which will be the following Monday, July 26. It is hoped that many American friends and colleagues will be able to attend.

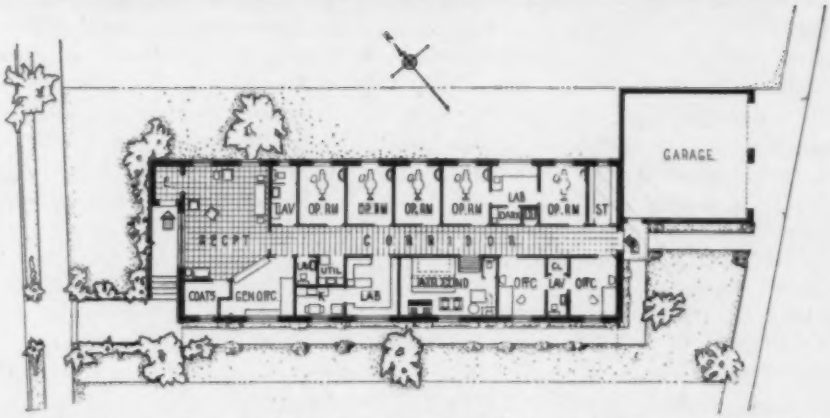
Inquiries should be sent to the Honorary Secretary,

Mr. L. Russell Marsh
19, Harcourt House,
19, Cavendish Square,
London, W. 1.

or to the Honorary Treasurer,

Dr. O. Henry
11B, Portland Place,
London, W.1.

Offices of Dr. Oren A. Oliver and Dr. William O. Oliver, Nashville, Tennessee



These offices, recently completed, have been entirely planned and constructed for the practice of orthodontics exclusively. They are thought, therefore, to be of particular interest to the readers of the AMERICAN JOURNAL OF ORTHODONTICS.

The Fourth Annual Seminar for the Study and Practice of Dental Medicine

The West Coast's Fourth Annual Seminar for the Study and Practice of Dental Medicine was held at the Ahwahnee Hotel, Yosemite Valley, California, Oct. 19 to 24, 1947.

More than two hundred dentists, physicians, and research scientists were in attendance throughout the five-day session, as well as nine lecturers from five leading educational institutions.

Launched four years ago as an experiment in postgraduate education, the Seminar has proved the effectiveness of this plan where participants and faculty live and work together. Among outstanding results has been a degree of exchange between essayists and seminarians quite unobtainable in most other types of meetings, according to Dr. Hermann Becks, Professor of Dental Medicine at the University of California and President of the Seminar.

"Interim study and the preparation of case reports is a requisite to attendance," Dr. Becks pointed out. "The Seminar thus culminates preparation and practice of the principles of dental medicine, with the additional advantage that essayists need devote only a minimum portion of their time to reviewing the basic principles of their special fields."

All meals served during the Seminar were planned by Dr. Michael J. Walsh, Consulting Nutritionist of San Diego, California, as practical demonstrations of types of diets which may be recommended for dental patients. Omitting all sugars, ice cream, and pastries, the meals combined the maximum possible quantities of essential nutrients with the minimum

number of calories so that "the seminarians might return to their offices at the conclusion of the Seminar with a sense of physiological well-being," according to Dr. Walsh.

Highlights of the lectures were as follows:

The opening speaker, Dr. Edwin McMillan, Professor of Physics at the University of California, talked on "Application of Nuclear Physics in Biology and Medicine." Dr. McMillan gave a brief review of nuclear theory and described the cyclotron and the uranium pile as the two means of making radioactive materials. He discussed the method of using the so-called tagged atoms in tracer studies, and pointed out that in these experiments the amount of radiation is too small to produce any physiologic effects. "The nuclear physicists can furnish the active isotopes and the detecting equipment, but the experiments must be planned by those who know the problems to be answered in their own fields of interest," he said. Relatively little has been done with tracers in fields connected with dentistry, where there are great opportunities for pioneer work.

Dr. William A. Albrecht, Professor of Soils, College of Agriculture, University of Missouri, spoke on the general subject, "Climate, Soil and Health." In the first lecture, "Climatic Soil Pattern and Food Composition," he pointed out that food quality comes from the soil, but bulk from the weather, since many more and larger quantities of nutrients or fertility of the soil are required for proteins than for the production of carbohydrates. In general, the United States gives a picture of highly weathered soils in the East and Southeast, leached of their fertility by high rainfall, while the West under lower rainfall represents soils under construction where the vegetation is mineral rich and where the legume crops grow naturally. He cited chemical analysis of crop plants native to the different regions of the United States, and suggested that crop juggling encourages disregard of soil fertility.

In his second lecture, "Managing Health via the Soil," Dr. Albrecht pointed out that while the infectious diseases have been put under control, the degenerative diseases have increased. He gave statistics to show that increasing caries go with decreasing soil fertility, and suggested that calcium as a fertilizer has more value than merely counteracting soil acidity. Poor health and teeth may be linked to soil deficiencies in phosphorus, calcium, and other nutrients, he thinks. Management of animal health via the soil is already being practiced, he reported, and directed attention toward the possibilities of preventive medicine by means of the quality of food in terms of the soils which grow them.

Dr. L. H. Newburgh, Professor of Clinical Investigation in the Medical School, University of Michigan, spoke on "Man's Energy Requirements." He reviewed the concept of the sun as the source of all energy of life and pointed out that the equation

$$6\ CO_2 + 6\ H_2O \rightleftarrows C_6H_{12}O_6 + 6\ O_2$$

goes to the right for the production of carbohydrates by the plant and is reversed in the oxidation of these carbohydrates by the animal. He described the bomb calorimeter used to measure the amount of potential energy in food, and showed that only 70 per cent of the energy in protein is available to man. He discussed basal metabolic rate and the work performed by the body both internally and externally. "Body heat is the final state in the transformation of energy, and the higher forms of life have learned to take advantage of this and have developed elaborate systems for controlling the loss of heat to the outer world," he said. He described the measurement of the amount of body heat and said that, barring abnormal conditions, the outflow of heat keeps pace with its production; fevers, of which two distinct types are recognized, present interesting abnormalities in heat regulation.

Dr. Isaac Schour, Professor of Histology, College of Dentistry, University of Illinois, spoke on the "Development and Growth of Teeth," which he said is a progressive, orderly, and timed schedule of dynamic stages and events. He stated that the growth of the enamel of a permanent tooth takes about six years, but the development of the entire tooth is a lifelong process that ends only with its extraction or the death of the possessor. He outlined the successive phases in growth and calcification, discussed tooth ring analysis, hypocalcification and mottled enamel, and the tooth as an indicator of health and disease. "Many clinical conditions which confront the dentist in his daily practice are of developmental origin and

can be understood and classified best in terms of the particular stage of development from which they arise,'' he said. The principles of growth illustrated in the teeth apply to a large extent to bone growth as well, but a study of the teeth facilitates their recognition since tooth growth is more regular and more stable than bone growth.

''Nutrition, Growth, and Development,'' was the subject of Dr. John B. Youmans, Dean of the College of Medicine, University of Illinois. Deficiencies of nutrients, if severe, may prevent conception or, if less severe, may result in abortions or stillbirths, he said. Lack of proper food for the mother may cause poor general development of the child, underweight, and illnesses such as beriberi, scurvy, and rickets. In animals, specific nutritional deficiencies also have been found to produce certain congenital anomalies and defects. He pointed out that children under a limitation of various nutrients cease to grow or slow their growth rate and delay maturation. His second talk dealt with the nutrition needed by adults for the maintenance of normal tissue structure and the performance of certain bodily functions, as well as the repair necessitated by injury or disease. When there is deficiency of calories, the body uses first its small reserves of carbohydrates and glycogen, then its stored fat, and, finally, the native protein of tissues and organs; he said that this latter results in loss of endurance and other disturbances. He discussed protective mechanisms, hunger edema, the role of the amino acids, and the part which the vitamins, A, C, and D, and folic acid play in undernutrition.

Dr. Howard B. Lewis, Professor of Biological Chemistry, University of Michigan, spoke on the ''Biologic Functions of Proteins'' and stated that no life appears possible on our planet without these substances. He discussed the size and molecular weight of the protein molecules and pointed out that they are composed of amino acids joined together in peptide linkage, that they are almost infinite in number, and exhibit a species specificity. Digestion in the body breaks the proteins into amino acids, which are absorbed by the tissues and used by the body to form new proteins of the cells, body fluids, hormones, and enzymes. Excess acids are deaminized and the nitrogen excreted as urea.

Dr. Lewis' second lecture dealt with the ''Role of Amino Acids in Nutrition.'' Ten amino acids were found to be essential for growth and development of the white rat. ''The essential amino acids for man were studied by means of nitrogen balance, and mixtures of amino acids are being used clinically as protein hydrolysates,'' he said. Standards for protein recommend 70 Gm. a day for a 70-kilogram man and 60 Gm. for a woman weighing 56 kilograms, with recommendations for pregnancy and lactation greater. These should be selected from a wide variety of diet sources.

Dr. Allan G. Brodie, Professor of Orthodontics and Dean of the College of Dentistry, University of Illinois, talked on ''Growth of the Jaws and Eruption of the Teeth,'' giving a synthesis of the findings of his own investigations and those of a number of other workers. ''The pattern of the head skeleton is laid down well before birth,'' he said. ''The brain, soft palate, and tongue are well advanced in development at birth, and the brain case has much of its growth but its parts have not coalesced.'' He outlined the growth of the maxilla and mandible, giving the growth sites as revealed by vital staining, and stated that these sites are so perfectly coordinated that no changes in proportion occur between infancy and adulthood. He said the presence or absence of teeth has no effect on this growth.

In his second talk, ''Eruption of the Teeth and Growth of Alveolar Bone,'' Dr. Brodie discussed the relationship between alveolar bone growth and tooth development and eruption. He pointed out several phenomena associated with the eruption process that lead to changes in relationships between the two dentitions, and emphasized the fact that variation shows itself in every detail in developing teeth and bone.

Dr. Gustav W. Rapp, Professor of Chemistry and Physiology, Chicago College of Dental Surgery, Loyola University, discussed the mechanism of enzyme action. He defined an enzyme as a special kind of catalyst produced by living cells, and said they seem to be made of three main components: the apoenzyme, a large specific protein particle; the coenzyme, a nonproteinaceous organic molecule; and a metallic ion. Their mode of action apparently consists of a physical absorption of the substrate component onto the surface of the enzyme molecule, a specific chemical reaction between the substrate components, and desorption or removal of the changed substrate from the enzyme surface.

In his second lecture, "An Enzymatic Theory of Local Anesthesia," Dr. Rapp discussed the theory of nerve impulse and pointed out that the common local anesthetics are, up to a certain point, similar in structure to that of acetylcholine, by means of which nervous energy is produced. "It would seem that the anesthetics have the necessary qualifications for the first phase of the enzyme activity but not subsequent ones," he said.

The final lecturer, Dr. Thomas Francis, Jr., Professor of Epidemiology, School of Public Health, University of Michigan, spoke on "Viruses as Agents of Disease." "The viruses tend to attack a specific type of cell and cause a specific tissue injury, as well as causing some types of tumors," he said. Many viruses have inclusion bodies, all require living cells for their propagation, and stimulate immunologic reactions on the part of their host. He gave a classification of virus diseases and pointed out that the mouth constitutes the greatest single portal of entry of virus disease in man.

In his second lecture, "The Prevention of Virus Diseases," Dr. Francis said that the presence of antibodies is not synonymous with immunity, and their significance depends upon the mechanisms involved in the individual diseases. He discussed immunization by both active and inactive viruses, and discussed the prevention or modification of virus diseases by use of immune sera. Recent work has opened up the possibility of nonspecific immunity by means of the phenomenon of interference in which a chemical or a harmless virus can be used to block the entrance to the cell, or in which the physiologic conditions of the cell are so modified that it no longer serves as an efficient host to the virus.

Plans are now being made for the Fifth Annual Seminar for the Study and Practice of Dental Medicine which will be held at The Desert Inn, Palm Springs, California, Oct. 17 to 22, 1948.

Washington University School of Dentistry Postgraduate Course for Orthodontists

A comprehensive two-week course in labiolingual orthodontic technique was held at Washington University School of Dentistry Jan. 19 to 31, 1948.

The entire course was under the direction of Oren A. Oliver, D.D.S., and Russell E. Irish, B.S., M.A., D.D.S. They were assisted by Boyd W. Tarpley, B.A., D.D.S., and Harold K. Terry, B.A., D.D.S.

Lectures on fundamental problems in orthodontics, as well as a complete laboratory course in construction of appliances including the occlusal guide plane, were conducted. Practice demonstration of these principles was supplied, as well as student construction of appliances for cases from their own practices.

Supplementing the technical aspect were the scientific presentations as follows:

Embryology. L. R. Boling, Ph.D., Professor of Anatomy, Washington University School of Dentistry.

Relation of Nose and Throat to the Oral Cavity. G. Neal Proud, M.D., Instructor in Clinical Otolaryngology, Washington University School of Medicine.

Radiodontics. C. O. Simpson, D.D.S., M.D., Professor of Radiodontics, Washington University School of Dentistry.

Endocrinology and Growth and Development. M. J. Carson, M.D., Assistant Professor of Pediatrics, Washington University School of Medicine.

Genetics. Harrison D. Stolker, Ph.D., Assistant Professor of Zoology, Washington University.

Postsurgical Rehabilitation. L. W. O'Brien, D.D.S., Assistant Professor of Clinical Dental Prosthetics, Washington University School of Dentistry.

Speech Correction. Mildred A. McGinnis, M.A., Head of Speech Department, Central Institute for the Deaf.

Anatomy of Head and Neck. L. R. Boling, Ph.D., Professor of Anatomy, Washington University School of Dentistry.

Ear Syndromes and Temporomandibular Relations. James B. Costen, M.D., Assistant Professor of Clinical Otolaryngology, Washington University School of Medicine.

Cleft Palate Problems. James Barrett Brown, M.D., Professor of Maxillofacial Surgery, Washington University School of Dentistry.

Dentistry for Children—Preventive Orthodontics. Ruth E. Martin, D.D.S., Professor of Dental Pediatrics, Washington University School of Dentistry, and Earl E. Shepard, D.D.S., Assistant Professor of Dental Materials and Orthodontics, Washington University School of Dentistry.

Some Thoughts on Esthetics. Edmund H. Wuerpel, Dean Emeritus, Washington University School of Fine Arts.

The Third Molar. R. B. Rode, D.D.S., Professor of Clinical Oral Surgery, Washington University School of Dentistry.

Oral Pathology. B. M. Levy, D.D.S., M.S., Associate Professor of Oral Pathology, Washington University School of Dentistry.

Surgical Correction of Mandibular Prognathism. L. W. Peterson, D.D.S., Associate Professor of Oral Surgery, Washington University School of Dentistry.

Admission to the course was limited to persons in the exclusive practice of orthodontics, teachers or graduate students of orthodontics, whose experience and background qualified them for the course.

Dr. Andrew F. Jackson

Dr. Andrew F. Jackson, Orthodontist of Philadelphia, Pennsylvania, along with Mrs. Jackson, recently returned from a six-week trip which included visits to a number of the principal cities of South America. Two weeks were spent in Buenos Aires, where four orthodontic lectures were presented—one at the university, one before the Odontologic Society of Buenos Aires, another before the orthodontic society, and another before the orthodontic clinic of Buenos Aires. A talk was made in Montevideo, Uruguay, and still another at the university in Concepcion, Chile.

Dr. and Mrs. Jackson spent two weeks in Santiago, Chile, where he delivered two lectures on the subject of orthodontics, another in Valparaiso, Chile, and two more in Lima, Peru.

It seems that as a result of good will missions made by various orthodontists to Latin America within recent years, along with the Pan-American meeting held in New Orleans several years ago, orthodontic understanding within the Western Hemisphere has been well cemented. This will no doubt insure cooperation of the workers within the specialty in the two hemispheres in the future.

In all, Dr. Jackson presented ten lectures in Spanish during his six-week trip, and he was presented with seven honorary memberships. Dr. Jackson was born in Concepcion, Chile, and spent much of his boyhood in South America.

Notes of Interest

Dr. B. L. Herzberg announces the removal of his office to 7200 Exchange Avenue, Chicago 49, Illinois, telephone South Shore 3101, practice limited to orthodontics.

Dr. Henry F. Hoffman announces the removal of his office to 932 Metropolitan Building, Denver, Colorado, practice limited to orthodontics.

Dr. Joseph A. Stepka announces the opening of his office at 11 Bay Shore Avenue, Bay Shore, Long Island, New York, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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President-Elect, Lowrie J. Porter - - - - - - - - - 41 East 57th St., New York, N. Y.
Vice-President, G. Vernon Fisk - - - - - - 818 Medical Arts Bldg., Toronto, Ont., Can.
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Central Section of the American Association of Orthodontists

President, Ralph G. Bengston - - - - - - - - - 25 E. Washington St., Chicago, Ill.
Secretary-Treasurer, Earl E. Shepard - - - - - - - - - 4500 Olive St., St. Louis, Mo.

Great Lakes Society of Orthodontists

President, Elmer F. Boester - - - - - - - - - - 1821 Republic Bldg., Cleveland, Ohio
Secretary-Treasurer, Scott T. Holmes, 509 Hackley Union National Bank Bldg., Muskegon, Mich.

Northeastern Society of Orthodontists

President, John W. Ross - - - - - - - - - - - - 1520 Spruce St., Philadelphia, Pa.
Secretary-Treasurer, Oscar Jacobson - - - - - - - - 35 W. 81st St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, S. B. Hoskins - - - - - - - - - - - Medical Dental Bldg., Portland, Ore.
Secretary-Treasurer, Frederick T. West - - - - - 870 Market St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Fred Bowden - - - - - - - - - - - - - Republic Bldg., Denver, Colo.
Vice-President, Harry V. Banks - - - - - - - - - - - 1550 Lincoln, Denver, Colo.
Secretary-Treasurer, Elmer S. Linderholm - - - - - - - 1558 Humboldt, Denver, Colo.

Southern Society of Orthodontists

President, Neil J. Leonard - - - - - - - - - - - - Exchange Bldg., Memphis, Tenn.
Secretary, Leland T. Daniel - - - - - - - - - - - - American Bldg., Orlando, Fla.

Southwestern Society of Orthodontists

President, R. E. Olson - - - - - - - - - - - - - - - 712 Bitting Bldg., Wichita, Kan.
Secretary-Treasurer, Marion A. Flesher - - - Medical Arts Bldg., Oklahoma City, Okla.

American Board of Orthodontics

President, Oliver W. White - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
Vice-President, Joseph D. Eby - - - - - - - - - - 121 E. 60th St., New York, N. Y.
Secretary, Bernard G. deVries - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
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Stephen C. Hopkins - - - - - - - 1726 Eye St., N.W., Washington, D. C.
Reuben E. Olson - - - - - - - - - - - - 712 Bitting Bldg., Wichita, Kan.

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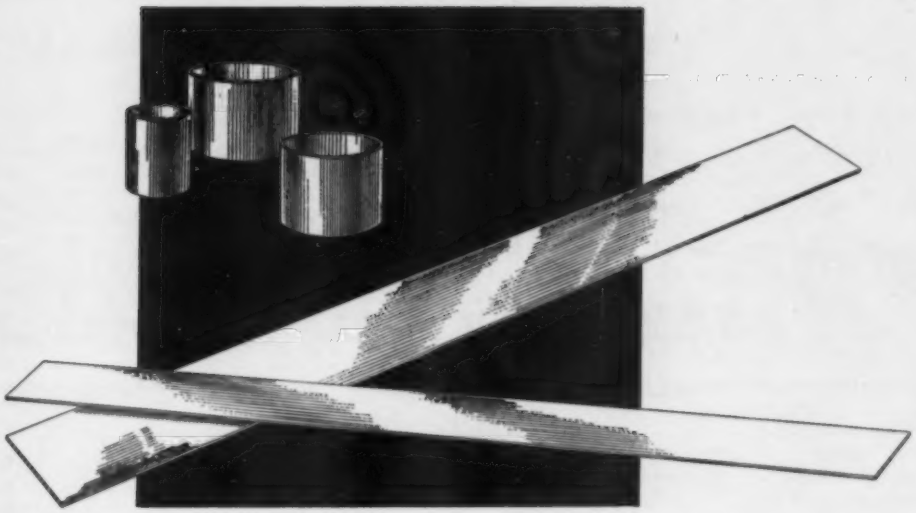

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